DIGITIZING MICROFILMS FOR DOCUMENT MANAGEMENT AND FILING ARCHIVAL SYSTEM

ADILBEK BULATOV

UNIVERSITI TEKNOLOGI MALAYSIA

DIGITIZING MICROFILMS FOR DOCUMENT MANAGEMENT AND FILING ARCHIVAL SYSTEM

ADILBEK BULATOV

A project report submitted in fulfillment of the
requirements for the award of the degree of
Master of Science (Information Technology - Management)

Faculty of Computer Science and Information Systems
Universiti Teknologi Malaysia

APRIL 2009

To my beloved mother and sister

ACKNOWLEDGEMENT

Firstly, I would like to express my thanks to my supervisor, Dr. Ali Bin Selamat, for encouragement, guidance and helpful advices.

My deepest thanks also go to my examiners, Dr. Roliana Binti Ibrahim and Dr. Noorminshah Binti A.Iahad for their constructive comments and help by giving recommendations and ideas as well.

I want to express my gratitude to my family members for their continuous moral support and understanding throughout the time of studying.

My special thanks goes to all my friends especially Ardak Amirbekov for being supportive, for understanding me through hard times and difficulties.

ABSTRACT

This project is about implementation of Document Management and Filing Archival System for Digital Library. From initial findings, the current method of preservation archival data using microfilm technology in Sultanah Zanariah Library is not effective because the process of storing, retrieval and searching documents is done manually. The main disadvantage of current system is that this system does not support simultaneous access of several users to this data. The proposed system is based on use of Digital Imaging technology and will help to solve the problem connected to access. After digitizing the library's microfilm collections it will become possible to view it through local area network or Internet. It is hoped that after this system is implemented the number of library's users who want to view this information will increase.

ABSTRAK

Bilangan buku dan bahan-bahan bacaan lain di perpustakaan kini telah mencecah jumlah yang sangat besar dan angka ini semakin bertambah hari demi hari. Penyimpanan dan penjagaan buku-buku dan bahan bacaan sedia ada ini menjadi sangat penting bagi setiap perpustakaan.

Projek yang sedang saya jalankan ini adalah tentang perlaksanaan Sistem Pengurusan Dokumen dan Penyimpanan Fail bagi Perpustakaan Digital. Berdasarkan kajian awalan, kaedah semasa yang digunakan untuk menyimpan data dari bahan-bahan bacaan bagi Perpustakaan Sultanah Zanariah adalah dengan menggunakan teknologi '*microfilm*' , di mana kaedah ini merupakan kaedah yang kurang efektif kerana proses untuk menyimpan, mencapai dan carian dokumen atau data dilakukan secara manual.

Kekurangan utama yang terdapat pada sistem sedia ada adalah kerana sistem ini tidak dapat menyokong capaian yang dibuat secara serentak oleh pengguna semasa ke atas data yang dikehendaki. Sistem yang dicadangkan adalah berdasarkan kepada penggunaan teknologi Imej Digital dan ia dapat membantu untuk menyelesaikan masalah berhubung capaian. Selepas memperangkakan koleksi '*microfilm*' perpustakaan, maklumat dan data akan boleh dicapai melalui *Local Area Network* (LAN) atau Internet.

Diharapkan agar selepas perlaksanaan sistem ini dilakukan, pengguna yang ingin mencari dan mendapatkan maklumat dari perpustakaan akan lebih bertambah.

TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
DECLARATION		**ii**
DEDICATION		**iii**
ACKNOWLEDGEMENT		**iv**
ABSTRACT		**v**
ABSTRAK		**vi**
LIST OF TABLES		**xiii**
LIST OF FIGURES		**xiv**
LIST OF APPENDICES		**xvi**
1	**PROJECT OVERVIEW**	**1**
1.1	Introduction	1
1.2	Background of the problem	2
1.3	Statement of the problem	2
1.4	Project objective	3
1.5	Project scope	3
1.6	Importance of project	4
1.7	Chapter summary	4
2	**LITERATURE REVIEW**	**6**
2.1	Introduction	6
2.2	Document management	7
2.2.1	Components	7
2.2.2	Metadata	8
2.2.3	Integration	8

2.2.4 Capture 8
2.2.5 Indexing 9
2.2.6 Storage 9
2.2.7 Retrieval 9
2.2.8 Distribution 9
2.2.9 Security 10
2.2.10 Workflow 10
2.2.11 Collaboration 10
2.2.12 Versioning 11
2.2.13 Publishing 11
2.3 Digital Library 11
2.4 Archival System 13
2.4.1 Micrographics 13
2.4.1.1 Filming 13
2.4.1.2 Indexing 15
2.4.1.3 Processing 15
2.4.1.4 Storage 16
2.4.1.5 Retrieval 19
2.4.2 Digital imaging 20
2.4.2.1 Capture or Scanning 21
2.4.2.2 Indexing 22
2.4.2.3 Storage 23
2.4.2.4 Retrieval 23
2.4.2.5 Distribution 24
2.4.2.6 Digital Preservation 24
2.5 Advantages and disadvantages of each technology 25
2.5.1 Micrographics 25
2.5.2 Digital imaging 26
2.6 Resolution, the Key Design Element 27
2.6.1 Micrographics 27
2.6.2 Digital imaging 29
2.7 Image Access, Distribution, and Transmission 31
2.8 Microfilm Digitization projects 32

2.8.1 Simon Fraser University Digital Retrospective Conversion of Theses and Dissertations 32
2.8.2 CRL/LAMP Brazilian Government Serials Digitization Project 34
2.8.2.1 Scanning Eguipment and Processing 36
2.8.2.2 Indexing the Document Collection 37
2.8.3 The Tundra Times Newspaper Digitization Project 39
2.8.3.1 Digitization Process 40
2.8.3.2 Microfilm Scanning 40
2.8.3.3 Metadata 41
2.8.3.4 OCR Processing 42
2.8.3.5 Costs 42
2.9 Microfilm Scanners 43
2.9.1 Canon Microfilm Scanner 800 MS800 SCSI Connection 43
2.9.2 ScanPro 1000 microfilm scanner 45
2.9.3 SpeedScan 3 in 1 Microfilm Scanner 46
2.9.4 FlexScan 2 in 1 Scanner for Rollfilm and Microfiche 48
2.10 Chapter summary 51

3 PROJECT METHODOLOGY 52
3.1 Introduction 52
3.2 Project Methodology 53
3.2.1 Initial Planning Phase 53
3.2.2 Analysis Phase 53
3.2.2.1 Study Current System 54
3.2.2.2 Literature Review 54
3.2.2.3 Data Collection and Data Analysis 54
3.2.3 Microfilm Digitization 55
3.2.3.1 Scanning Process 55
3.2.3.2 Cataloging and Indexing Scanned Microfilms 57
3.2.4 Design 60
3.2.5 Implementation 60
3.3 System development methodology 63
3.3.1 The Unified Process 63
3.3.1.1 Inception Phase 64

3.3.1.2 Elaboration Phase 64
3.3.1.3 Construction Phase 64
3.3.1.4 Transition Phase 65
3.3.2 Object Oriented Approach 65
3.3.3 UML Notation 66
3.4 System Requirement Analysis 67
3.4.1 Hardware Requirements 67
3.4.2 Software Requirements 68
3.5 Project Schedule 69
3.6 Chapter summary 69

4 SYSTEM DESIGN 70
4.1 Organizational analysis 70
4.1.1 Introduction 70
4.1.1.1 Mission & Goals 71
4.1.2 Structure 72
4.1.3 Functions 72
4.1.4 Problem statement in the organizational context 73
4.1.5 Case study 73
4.1.5.1 Introduction 73
4.1.5.2 The process of filming and storing of microfilms in Sultanah Zanariah Library 75
4.2 As-Is Process and Data Model 78
4.2.1 Use Case Diagram 78
4.2.2 Use Case Description 80
4.2.3 Sequence Diagram 83
4.2.4 Activity Diagram 85
4.3 To-Be Process and Data Model 86
4.3.1 Use Case Diagram 86
4.3.2 Use Case Description 87
4.3.3 Class Diagram 90
4.3.4 Sequence Diagram 90
4.3.5 Activity Diagram 91
4.4 System Architecture 92

4.5 Physical Design 95
4.5.1 Database Design 95
4.5.2 Program (Structure) Chart 96
4.5.3 Interface Chart 97
4.5.4 Detailed Modules/Features 98
4.6 Hardware Requirements 101
4.7 Chapter summary 102

5 DESIGN IMPLEMENTATION AND TESTING 103
5.1 Coding Approach 103
5.1.1 Snapshot of Critical Programming Codes 105
5.2 Test Result/ System Evaluation 106
5.2.1 Unit Testing 106
5.2.2 User Acceptance Test 108
5.3 User Manual 108
5.4 Chapter summary 109

6 ORGANIZATIONAL STRATEGY 110
6.1. Rollout Strategy 110
6.2. Change Management 111
6.3. Data Migration Plan 113
6.4. Business Continuity Plan (BCP) 114
6.5. Expected Competitive Advantage Gain from the Proposed System 114
6.6. Chapter summary 115

7 CONCLUSIONS 116
7.1 Introduction 116
7.2 Achievements 117
7.3 Constraints and Challenges 117
7.4 Aspirations 118
7.5 Future work 118
7.6 Summary 119

REFERENCES **120**

Appendices A-H 122-166

LIST OF TABLES

TABLE NO	TITLE	PAGE
2.1	Attributes of Micrographics	25
2.2	Attributes of Digital Imaging	26
2.3	Per Page Digitization Costs	42
2.4	SpeedScan Hardware Specifications	46
2.5	FlexScan w/NextStar Specifications	49
3.1	Detail every phase in project Methodology Framework	61
3.2	Software required developing the system	68
4.1	Use Case Description for Enter request	80
4.2	Use Case Description for Get microfilm call number	81
4.3	Use Case Description for Get microfilm	81
4.4	Use Case Description for View thesis	82
4.5	Use Case Description for Search thesis	88
4.6	Use Case Description for Get list of theses	88
4.7	Use Case Description for View thesis	89
4.8	Database design for the Web-based Document Management and Filing Archival System	95
4.9	Hardware Requirements for proposed system	101
5.1	System evaluation test for Clients of the proposed system	106
5.2	System evaluation test for Staff of the proposed system	107

LIST OF FIGURES

FIGURE NO	TITLE	PAGE
2.1	Planetary Microfilmer	14
2.2	Rotary Microfilmer	15
2.3	Archival vault	16
2.4	Positive roll film	18
2.5	Aperture card	18
2.6	Microfiche card	19
2.7	Microfilm reader	20
2.8	Overhead Scanner	22
2.9	Project Website[http://www.crl.uchicago.edu/info/brazil]	37
2.10	Pagination File 245	38
2.11	Table of Contents	38
2.12	Subject headings	39
2.13	Canon MS800 Microfilm scanner	44
2.14	ScanPro 1000 Microfilm scanner	46
2.15	SpeedScan 3 in 1 Microfilm Scanner	47
2.16	FlexScan 2 in 1 Microfilm Scanner	51
3.1	Background Recognition process	56
3.2	OCR Processing	58
3.3	PDF saving options	59
3.4	PDF Security Settings	59
4.1	Microfilm reader machine	74
4.2	The process of thesis unbinding	75

4.3	The process of filming pages by Planetary Microfilming camera	76
4.4	Microfilm processor	76
4.5	The process of checking microfilm	76
4.6	Microfilm archive vault	77
4.7	Silica gel inside of shelves	77
4.8	Use Case Diagram for As-Is System	79
4.9	Sequence Diagram for View thesis	84
4.10	Sequence Diagram for Give microfilm	84
4.11	Activity Diagram for current process	85
4.12	Use Case Diagram for To-Be System	87
4.13	Class Diagram	90
4.14	Sequence Diagram for User of proposed system	91
4.15	Activity Diagram for proposed system	92
4.16	Digital Library Network	93
4.17	System Architecture	94
4.18	Database Design	96
4.19	Interface Chart	98
4.20	Main page of Student Module	99
4.21	Manage Librarian from Admin Module	100
4.22	Add Thesis menu from Librarian Module	101
6.1..	Implementation guideline for proposed system	104

LIST OF APPENDICES

APPENDIX	TITLE	PAGE
A	Gantt Chart	122
B	Interview Questions	129
C	Organizational Chart of PSZ Library	131
D	Database Design	133
E	Critical programming codes	135
F	User Acceptance Test Questionnaires	142
G	5 samples of user's feedback	145
H	User Manual and Technical Documentation	150

CHAPTER I

PROJECT OVERVIEW

1.1 Introduction

Nowadays the number of books and materials in libraries has reached huge sizes and continue to grow. Librarians are facing problems on how to preserve these materials. Some of the Library's potential problems are growing paper collections, bursting card catalogs and lack of shelving space – are the verge to be solved.

The use of microfilms has allowed reducing space which was required for storage of standard paper documents earlier. However microfilms have the lacks connected to access, search and indexing. Presently, when the Internet and computers have entered into all spheres of our life, we should use all possibilities which they give us, to gain access to knowledge and information.

1.2 Background of the problem

The libraries all over the world as a source of long-term preservation are using the micrographics technology. There is a lot of information which stored on microfilms are closed for wide access because the data storage system based on microfilms does not support simultaneous access of several users to the same document. Since the microfilm format is not conductive to be accessed or delivered at locations other than the Library microfilm reading room, many library users refrain themselves from using microfilm. In many instances the user's adverse attitude toward microforms in general, (microfilm/microfiche in particular) is the result of such factors as inadequate cataloging , inefficient bibliographic access, scratches on film surface, breaks and smudges, making the text illegible, and in some libraries, dungeon-like microform reading areas and in some cases, even complains about eye fatigue because of poor, inadequate lighting.

Also there is variety of the problems connected with storage of microfilms: a constant climate the control, purchase of the special equipment.

1.3 Statement of the problem

The problems to be tackled in this project are:

i) How can we computerize the process of microfilming?

ii) How to digitize the retrospective theses collection stored in microfilm format

iii) How to make microfilm collections more accessible by the librarians and the users of library?

1.4 Project objective

The objectives for the proposed system are:

i) To study and analyze existing methods / techniques to convert microfilm into digital format
ii) To study existing methods of cataloging and indexing of digital documents
iii) To design and test a web-based system to store and organize digitized microfilms (retrospective theses) for easy access and retrieval
iv) To formulate organizational strategies for the implementation of the system.

1.5 Project scope

This project, Document Management and Filing Archival System, is developed focusing on organizing and cataloging of retrospective theses collection of PSZ Library digitized from microfilms.

This section is to define the boundary of the project and consist of system functionalities, data used, software, hardware and platform requirements. It also describes features available and the system's user.

Software requirements needed are PHP as a programming language, Macromedia Dreamweaver MX 2004 to design interfaces, Microsoft SQL for

database, Microsoft Office 2003, Microsoft Project 2003, and Microsoft Visio Professional 2003 for project documentation.

This proposed system will be used by librarians and library's users with an authorized access.

1.6 Importance of project

The system is focused mainly on librarians and users of library. After implementation of this system it will become possible to refuse using microfilms as preservation medium which allow saving considerable amount of money resources. Some of the expected significant importances are as follows:

- Simultaneous access to the archive of retrospective theses
- Reduce time of accessing microfilms
- The number of library users who want to view and work with these retrospective theses increase

1.7 Chapter summary

In this chapter, introduction of the project, project objective, project scope, problem background and statement of problem background have been discussed.

The development of the proposed system was said to be a solution to the problems and challenges faced by libraries when they archive the historical data using microfilm technology. Te new system will be done to help both users and librarians. Users can easy access and view the information from archives in educational purposes. For librarians the Document Management and Filing Archival System helps to automate the process of storing, retrieval and searching historical data.

CHAPTER II

LITERATURE REVIEW

2.1 Introduction

Literature review is compulsory to support the decisions made on proposed system development. It helps to identify the most appropriate tools and technologies, techniques and approaches that are best in solving the problems. Therefore, the summary of findings from literature reviews i.e. Research Papers, Product Websites and Books are stated below. This chapter focuses on topics such as Digital Library, Document Management, Micrographics, and Digital Imaging.

2.2 Document management

A document management system (DMS) is a computer system (or set of computer programs) used to track and store electronic documents and/or images of paper documents [1]. There are several common issues that are involved in managing documents, whether the system is an informal, ad-hoc, paper-based method for one person or if it is a formal, structured, computer enhanced system for many people across multiple offices. Most methods for managing documents address the following areas:

i) Location
ii) Filing
iii) Retrieval
iv) Security
v) Disaster
vi) Recovery
vii) Retention
viii) Archiving
ix) Distribution
x) Workflow
xi) Authentication

2.2.1 Components

Document management systems commonly provide storage, versioning, metadata, security, as well as indexing and retrieval capabilities. Here is a description of these components:

2.2.2 Metadata

Metadata is typically stored for each document. Metadata may, for example, include the date the document was stored and the identity of the user storing it. The DMS may also extract metadata from the document automatically or prompt the user to add metadata.

2.2.3 Integration

Integration of the document management directly into other applications, so that users may retrieve existing documents directly from the document management system repository, make changes, and save the changed document back to the repository as a new version, all without leaving the application.

2.2.4 Capture

Capture images of paper documents using scanners or multifunction printers. *Optical Character Recognition* (OCR) software is often used, whether integrated into the hardware or as stand-alone software, in order to convert digital images into machine readable text.

2.2.5 Indexing

Track electronic documents. Indexing exists mainly to support retrieval. One area of critical importance for rapid retrieval is the creation of an index topology.

2.2.6 Storage

Store electronic documents. Often includes management of those documents.

2.2.7 Retrieval

Retrieve the electronic documents from the storage.

2.2.8 Distribution

A published document for distribution has to be in a format that can not be easily altered.

2.2.9 Security

Document security is vital in many document management applications.

2.2.10 Workflow

There are different types of workflow. Manual workflow requires a user to view the document and decide who to send it to. Rules-based workflow allows an administrator to create a rule that dictates the flow of the document through an organization.

2.2.11 Collaboration

Documents should be capable of being retrieved by an authorized user and worked on. Access should be blocked to other users while work is being performed on the document.

2.2.12 Versioning

Versioning is a process by which documents are checked in or out of the document management system, allowing users to retrieve previous versions and to continue work from a selected point.

2.2.13 Publishing

Publishing a document is sometime tedious and involves the procedures of proofreading, peer or public reviewing, authorizing, printing and approving etc.

2.3 Digital Library

With the advances in information technology and the popularity of the Internet, more and more reference resources, which were once available only in books and journals, are now widely available electronically on the network. Libraries are no longer bound within their walls. Not only the library has the option to access a wide range of databases, but also the alternative to digitize their resources and mount them on the network to provide broader access of its collection.

According to Donald J. Waters (1998), “Digital Libraries are organizations that provide the resources, including the specialized staff, to select, structure, offer

intellectual access to, interpret, distribute, preserve the integrity of, and ensure the persistence over time of collections of digital works so that they are readily and economically available for use by a defined community or set of communities."[2]

Synonyms:

- Library Without Walls
- Networked Library
- Virtual Library
- Electronic Library
- Digital Library

A library is considered as a digital library if it provides

- access to digital information by using a variety of networks, including the Internet
- services in an automated environment

A digital library usually has:

- Library automation system
- Web server acting as gateway to digital resources
- Subscriptions to various web-based resources
- CD-ROM network
- Electronic document delivery
- Collections of electronic journals and electronic books
- Digital libraries projects
- Internet resources selection
- etc.

2.4 Archival System

2.4.1 Micrographics

The process by which photographed images are much reduced in size and stored as miniature pictures.

A microfilm system consist of five basic operations:

- Filming
- Indexing
- Processing
- Storage
- Retrieval

Input

Output

2.4.1.1 Filming

The filming of documents is done by *microfilmer*, a special camera that takes miniature pictures on microfilm.

These cameras are very sophisticated; however, because of features such as automatic focus, exposure, and film advance, regular personnel can operate them with little training.

Some microfilmers double film; that is, two rolls of microfilm are made simultaneously. Special duplicating equipment also is available that can provide copies in seconds. The duplicate roll is very important for security purpose.

The basic kinds of microfilmers are:

Planetary. Documents are placed face up on a flat surface. The camera is positioned above the item to be photographed. Appropriate buttons are pushed to expose the film.

Figure 2.1 Planetary Microfilmer

Rotary. These microfilmers with automatic feeders can photograph documents very rapidly; for example, 640 checks per minute! Both the fronts and backs can be photographed at the same time.

Figure 2.2 Rotary Microfilmer

2.4.1.2 Indexing

Microforms are indexed to facilitate retrieval. In some instances, various index signals are photographed as filing guides. Indexing is accomplished by the use of standard alpha/numeric keyboard in the 3M Micrapoint system [3].

2.4.1.3 Processing

After photographing the image and indexing, the third step is processing. The film can be processed immediately after exposure by a microfilm processor or the film can be sent off-premises to a processing laboratory.

Photographing and processing can be accomplished in a one-step operation by using a *camera/processor*, a machine that exposes microfilm and develops it automatically.

2.4.1.4 Storage

After microfilm has been exposed, indexed, and processed, it must be stored for retrieval.

Low temperatures and low relative humidity promote chemical stability. Microfilms should be stored at temperatures less than 21˚ Celsius (70˚ Fahrenheit) with relative humidity less than 60% and good air circulation to inhibit fungus or mold germination.

Figure 2.3 Archival vault

Microfilm should be stored in dark enclosures to minimize damage from light. Enclosures should comply with preservation standards.

Microfilm storage areas should be located in a fire-resistant space that is kept clean and free of dust particles and other contaminants, as well as certain gases such as sulfur dioxide, hydrogen sulfide, ammonia, and ozone. All building materials and storage equipment should be noncombustible and noncorrosive.

Microfilms should be regularly inspected for signs of deterioration [4].

Various microformats are used for retaining microimages, such as [3]:

- Roll film
- Magazines
- Jackets
- Microfiche
- Film folios
- Aperture cards

Flat film - 105 x 148 mm flat film is used for micro images of very large engineering drawings. These may carry a title photographed or written along one edge. Typical reduction is about 20, representing a drawing that is 2.00 x 2.80 metres, that is 79 x 110 inches (2,800 mm). These films are stored as microfiche.

Microfilm - 16 mm or 35 mm film to motion picture standard is used, usually unperforated. Roll microfilm is stored on open reels or put into cassettes. The standard length for using roll film is 30.48 m (100 ft). One roll of 35 mm film may carry 600 images of large engineering drawings or 800 images of broadsheet newspaper pages. 16 mm film may carry 2,400 images of letter sized images as a single stream of micro images along the film set so that lines of text are parallel to

the sides of the film or 10,000 small documents, perhaps cheques or betting slips, with both sides of the originals set side by side on the film.

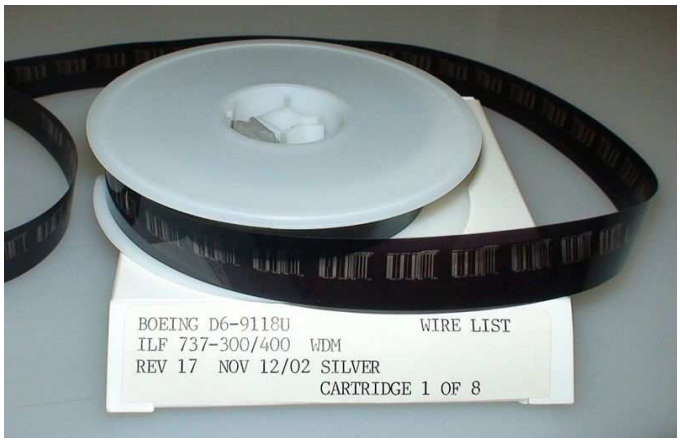


Figure 2.4 Positive roll film

Aperture cards are Hollerith cards into which a hole has been cut. A 35 mm microfilm chip is mounted in the hole inside of a clear plastic sleeve, or secured over the aperture by an adhesive tape. They are used for engineering drawings, for all engineering disciplines. There are libraries of these containing over 3 million cards. Aperture cards may be stored in drawers or in freestanding rotary units.

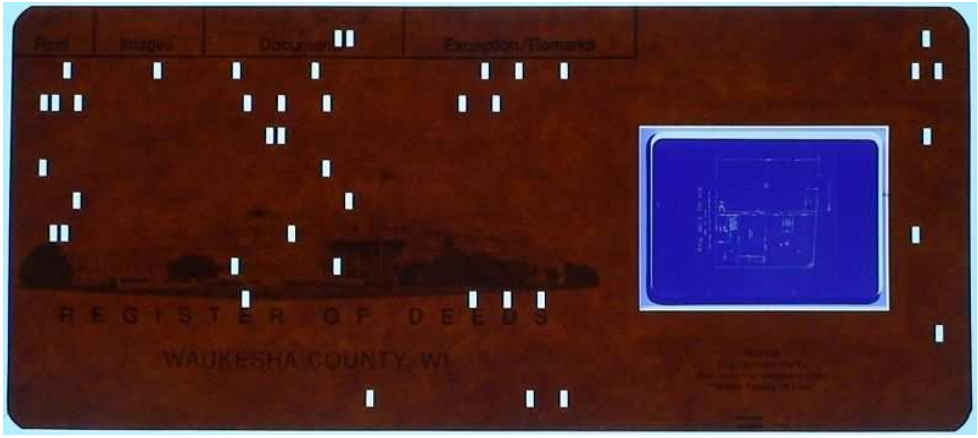


Figure 2.5 Aperture card

A microfiche is a flat film 105 x 148 mm in size. It carries a matrix of micro images. All microfiche are read with text parallel to the long side of the fiche. Frames may be landscape or portrait. Along the top of the fiche a title may be

recorded for visual identification. The most commonly used format is a portrait image of about 10 x 14 mm. Office size papers or magazine pages require a reduction of 24 or 25. Microfiche are stored in open top envelopes which are put in drawers or boxes as file cards, or fitted into pockets in purpose made books [4].

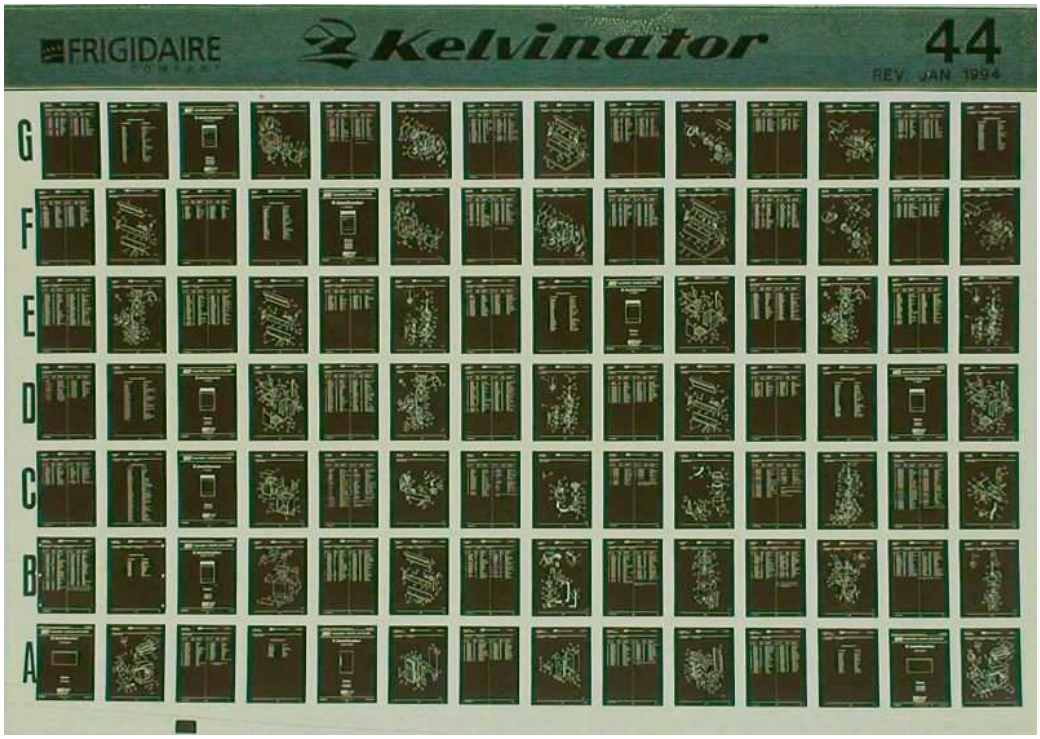


Figure 2.6 Microfiche card

2.4.1.5 Retrieval

The retrieval of items on microfilm is a very rapid process. The retrieval techniques employed are relative to the microformat in use. The general procedure is as follows:

1. The appropriate microfilm is selected from files.
2. The image is located on the microform and viewed on a reader or reader-printer.

3. If desired, a hard copy is made.

High-speed computer retrieval of microimages has fostered a new era of very rapid input and output of data and information. *Computer-assisted retrieval* (CAR) terminals speed up the retrieval process considerably. The computer searches for the document desired and either displays or print the location, called “identifier”, of the appropriate magazine being sought. The magazine is placed in a reader and the sought-after image is displayed very rapidly, in seconds [3].

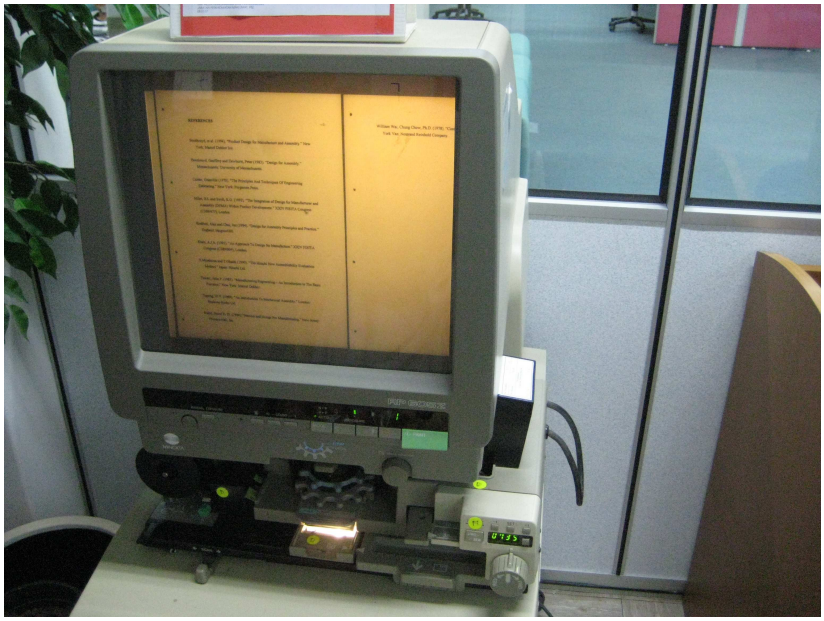


Figure 2.7 Microfilm reader

2.4.2 Digital imaging

Imaging is a straightforward technology. Every imaging system consist of six basic components:

- Capture/scanning

- Indexing
- Storage
- Retrieval
- Workflow/routing
- Presentation

Imaging is the process of converting existing source of information (picture, a page of text) into an electronic format using scanning device that takes the analog information, digitizes it, and creates a computer-based binary representation. After that electronic image is indexed for retrieval and filed in an on-line storage device.

2.4.2.1 Capture or Scanning

This is the conversion of existing paper-based information (documents) into electronic form (images). The process may include OCR (Optical Character Recognition), which will convert all or part of the textual portions within the scanned document into machine-readable form, such as an ASCII text file or word processing file.

The capture component of most imaging systems is represented by the physical processing of documents through a mechanical scanner [5].

Figure 2.8 Overhead Scanner

2.4.2.2 Indexing

Indexing is the most often overlooked elements of an imaging system. In the case of indexing there are distinct differences among low-end, off-the-shelf products and high-end customizable solutions. The difference is the support of standard database engine as opposed to a proprietary database or filing system. Both of these approaches may provide the functionality needed to index and retrieve the documents in the initial application, but proprietary DBMS will create havoc when migrating to another imaging system [5].

There is another dimension of indexing that is not easily found in most products. That is the ability to index a document on its complete textual context – often referred to as full-text retrieval. The systems must also provide an OCR component in order to convert the scanned image to text.

2.4.2.3 Storage

Storage is the component most often left to the user or developer to choose. Few solutions provide a storage mechanism as part of the imaging system. Although the storage overhead of a large imaging system would make it logical to use a form of optical storage, optical storage is not a requirement of imaging. In cases where it is determined that an optical storage facility will be used, implementation is still straightforward because optical storage technology is easily integrated with any system that supports an SCSI (Small Computer Systems Interface). Problems may come into play, however, when you begin to deliver imaging over the client/server architecture. Here the support of a particular network can become a critical issue.

2.4.2.4 Retrieval

Retrieval is innately related to the indexing scheme used. A filing system approach will use a filing cabinet, folder, and document-name metaphor to retrieve images. The DBMS approach, which is the most popular available, will provide key field retrieval for a set number of items that are entered manually by a data entry operator during the scanning process or are extracted by a field-oriented OCR. A text retrieval approach will provide retrieval based on the textual content of the documents [5].

2.4.2.5 Distribution

The most popular approach to distribution of images uses the file system of a client/server architecture to allow for distributed access to the images. In a client/server model, the images exist in compressed format on the image server and are sent to the client for decompression and viewing. The images do not permanently reside on the client workstation. This is especially important to adhere to since images can require significant storage space.

The integration of workflow software should be considered when evaluating th distribution requirements of an imaging system. Workflow does not require that the end user “request” an image, but rather proactively routes images throughout the network based on associated work process rules.

2.4.2.6 Digital Preservation

Files created to standard and documented with appropriate metadata need to be managed within a long-term maintenance environment to remain accessible. Active management of Digital files is necessary to handle the impermanence of optical and magnetic media and the rapid change in hardware and software configurations. Strategies include [6]:

- Refreshing (moving files to new storage media periodically without altering their format or content)
- Periodic checks for the integrity of the digital object (authenticity and completeness) using, for example, a checksum value
- Redundancy (keeping many copies of digital files and comparing them against each other to ensure no data are lost or corrupted)

- ✓ LOCKSS – Lots of Copies Keeps Stuff Safe (a program to build tools and provide support to libraries so they can create, preserve, and archive local electronic collections)

- Migration (periodic transformation of files to new digital formats to ensure continuing compatibility between file formats and applications)
- Emulation (enabling obsolete systems to be run on future unknown systems, making it possible to retrieve, display and use digital documents with their original software)

2.5 Advantages and disadvantages of each technology

2.5.1 Micrographics

Advantages: As a storage medium, microfilm is durable and relatively inexpensive. Standards for creating, processing, storing, and reading microfilm are well known; the equipment necessary to read microfilm is not likely to become obsolete (all that is needed is light and magnification); micrographics technology is not expected to change in the near future; microfilm copies are recognized as legally acceptable substitutes for original documents; microfilm can theoretically store high-quality grayscale images inexpensively; and it is a recognized archival medium with a large installed equipment base. See Table 2.1 below.

Table 2.1 Attributes of Micrographics

Advantages	**Disadvantages**
- relatively low cost - recognized archival medium - inexpensive reader	- slow retrieval speed - use can cause wear - integrity of manual files

- most cost-effective grayscale storage - accepted as a legal medium - excellent compaction - standards for creating, processing, duplicating, storing, and reading exist	- single-user access is a problem - less than ideal output quality - resolution loss with succeeding copies

Disadvantages: Film can become scratched when handled; consequently, archival film is usually stored in a vault, and only copies are distributed for general use. Each generation or succeeding copy loses resolution (about ten percent). In addition, most micrographics reader/printers must access the film manually; reader/printer blowbacks (printouts) are of poor quality; film creation variables are difficult to control; film quality can only be determined after filming is complete; and bad pages must be re-filmed and spliced in. Accessing data is hampered by the lack of adequate indexing mechanisms; impossibility of random access for users of library's microfilm; backlogged cataloging represents yet another drawback.

2.5.2 Digital imaging

Advantages: The digital image format offers ease of access; excellent transmission and distribution capabilities; electronic restoration and enhancement; high-quality user copies; and automated retrieval aids. With digital technology access to historic collections throughout the country can be as close as the nearest computer or printer. Notice that the primary focus is on improving user quality and providing better access to the information. See Table 2.2 below.

Table 2.2 Attributes of Digital Imaging

Advantages	**Disadvantages**
- excellent record access, distribution, and transmission	- relatively high but decreasing cost - relatively new technology

- multi-user simultaneous access - file integrity - improved quality possible through electronic image processing (restoration and enhancement) - high-quality printed output - no degradation on successive copies (each copy is as good as the original copy) - easily reformatted (cut and paste) - OCR to text possible - electronic links to provide retrieval of individual pages	- permanent, but not archival storage medium - not yet accepted as legal reproduction - implementation and operating costs increase in direct proportion to quality of captured image (resolution)

Disadvantages: The technology is relatively new; a digital image, displayed or printed, is not yet acceptable as a legal substitute for the original; standards are lacking in many areas; digital storage is not considered archival - it requires continuous monitoring and eventual or periodic rewrite; the drive systems will inevitably become obsolete; there are relatively high but rapidly declining storage costs; the cost to store high-resolution archival images increases as the quality increases; and grayscale images require even more storage space.

2.6 Resolution, the Key Design Element

2.6.1 Micrographics

Film resolution: Film resolution is typically defined as the ability to render visible fine detail of an object; a measure of sharpness, it is expressed as the number

of line-pairs per millimeter (lppm) that can be "resolved". A line-pair is one black and one white line juxtaposed. A series of line-pairs is said to be resolved if all lines in an array of line-pairs on a test target can be reliably identified. Film resolution is measured by photographing several test targets, and under a microscope, determining the smallest pattern on which the individual lines can be clearly distinguished. Research Libraries Group specifications require that a resolution target be part of the initial sequence of frames for each book on a film reel, and that the measured resolution be about 120 lppm, or a ten target.

Effective film resolution: Theoretically, microfilm is capable of storing resolutions of 1,000 lppm, but this theoretical limit is actually never achieved because even the best microfilm cameras operating under ideal conditions are limited to about 200 lppm. And, due to variations in lighting, exposure control, lens quality, focus, development chemistry, camera adjustment, vibration, and other variables in a production environment, high-quality 35mm 12X film is usually imaged at an effective resolution of about 120-150 lppm (The RLG standard identifies any resolution above 120 lppm, at a 12X reduction, as being excellent). This effective film resolution equates to a digital binary scanning resolution of approximately 700-900 dpi. It will be a few years before cost-effective digital image systems capable of handling this level of resolution are available on a production basis.

*Film is resolution-indifferent***:** A single frame of film can store an image at the maximum possible resolution for the film/camera combination being used. Film does not exact a premium for maximizing resolution. On the other hand, the cost of storing high-resolution digital images on any medium except film increases linearly as the resolution increases. This occurs in the digital image because with higher resolution more data points are required to accurately preserve the fidelity of the image. More data points demand more memory for storage. Film, on the other hand, is resolution-indifferent.

Film integrity: Archivists are comfortable preserving materials on microfilm, because they know that--assuming the film is manufactured, processed, and stored according to established standards--they are creating a permanent record that will possibly last hundreds of years.

2.6.2 Digital imaging

Digital image resolution: Digital image resolution is commonly defined as the number of electronic samples (dots or pixels) per linear unit measure in the vertical and horizontal scanning directions. The term pixel refers to (picture elements). A digital image is analogous to an electronic photograph. It consists of a series of pixels that can be reassembled in the proper sequence to reconstruct the original page. These pixels are represented in computer memory by a digital code. Most image scanners commercially available range in resolution from 200 to 600 dpi and are referred to as bitonal or binary scanners because the pixels can only be represented as either black (0) or white (1). If the scanner captures greyscale pixels, then the quality of any continuous tones or halftones on the page will be more accurately captured. Greyscale pixels reflect the value of the light being reflected off the page and, for 8 bit pixels, are represented by a number on a scale between pure black (0) to very white (256). The number (i.e., density) of dots is governed by the resolution of the digital image scanner. The higher the resolution, the higher the fidelity of this recreated representation.

Because these digital dots (pixels) are very small, a great deal of them are required to recreate the image. For example, at a resolution of 300 dpi, 90,000 dots

per square inch are generated. This is why large amounts of storage space are required to store high-quality image data.

It has been defined various levels of resolution referred to as follows:

- "Archival resolution" is defined as the resolution necessary to capture a faithful replica of the original document, regardless of cost. Currently this seems to be on the order , of 600 dpi with eight bits of greyscale, it may well turn out to be higher
- "Optimal archival resolution" is in effect the highest resolution that technology will economically support at any given point in time. It is aimed at achieving the optimal balance between minimal system cost and maximum image quality.
- "Adequate access resolution," on the order of 300 dpi binary, is defined as the resolution sufficient to capture about 99.9 percent of the information content of the page. It is not suitable for preservation; however, it is generally acceptable for most information access requirements.

Digital imaging is not resolution-indifferent: As resolution increases so does the amount of data captured. The time required to scan and process the image, the quality, fidelity, and amount of storage space required to store the image also increase in direct proportion to increasing resolution. System resolution objectives must be examined in depth during systems design. Design trade-offs involving quality versus cost will influence every decision regarding resolution.

2.7 Image Access, Distribution, and Transmission

Access: The system should be structured to satisfy the users' information access needs while minimizing movement of large image files. Dedicated CD-ROMs could provide access to facsimiles of very high-use preserved documents in image format. Local collections of less frequently used documents could be stored in CD-ROM jukebox servers on local area networks (LANs). Film stored in small computer-assisted retrieval (CAR) systems could provide access to the least frequently used preservation materials. It is reasonable to assume that copies of other preserved documents would be stored in a similar way at other institutions or at a central site.

A user might be able to search any number of bibliographic catalogues from the desktop to identify specific materials that meet his/her research criteria. Making this database accessible over the Internet or some other network would allow widespread automated access to these treasures. The researcher could search for topics of interest or browse the image database(s) at the document structure or page level.

Distribution: An average of 7,500 300-dpi compressed binary journal size page images fit on a single CD-ROM. This is equivalent to 50 books or 7.5 years of a journal publication. With production costs of about $0.50 per binary page image at adequate access resolution (including indexing and abstracting), mastering costs of $1,500, and unit costs of $2.00 per disc for 100 replications, one can distribute the disc to 100 locations at a manufacturing cost of about $50.00 per copy. In the future preservation system, even if film is the archival media of choice, document images on CD-ROM discs could be the access and distribution vehicle.

When a request is received for a less frequently accessed document stored only on intelligent film, the film could be automatically located, advanced to the proper frame, scanned to create a digital image, and the image transmitted back to the requester. The digital copy would then be stored on optical disc. Subsequent requests for that publication could be serviced from the digital copy on optical disc. Once the document is stored on digital media it should remain there for some period of time (defined by the institution). If during that time, the document is not accessed then it is erased. Any future request for the document will be filled from the archival copy on film, and the process will repeat itself. This storage hierarchy is intelligently managed by a computer. The more frequently accessed preservation materials migrate to the faster, more expensive media, while infrequently used documents are migrated back to the slower, least expensive media.

2.8 Microfilm Digitization projects

2.8.1 Simon Fraser University Digital Retrospective Conversion of Theses and Dissertations

Realizing the importance of easy access to and the promotion of the scholarly output of Simon Fraser University (Burnaby, BC, Canada) graduate students, the SFU Library began exploring a retrospective digitization plan for theses and dissertations. Starting in 2004 and knowing the cost of an outside agency to complete the work, the SFU Library explored establishing an in house retrospective plan to digitize the approximate 4500 theses and dissertations produced between 1965 and 1996.

Using student assistants, work commenced in the fall of 2004 with existing microfilm and paper theses. The items are digitized in PDF and stored within the Library's institutional repository using DSpace. Metadata is created from existing library catalogue records and the titles will also be linked from the catalogue. The project has shown to be cost effective when compared to the title by title costs provided by an outside agency.

Scanning was done from the microfiche copy when available or from paper if either the microfiche quality is not good enough or is not available. Students perform an initial physical scan of the fiche copy to review that the quality is appropriate and to check to see if an abundance of pictures, graphs, etc. exists that may not scan well. If the fiche fails this step, a digital copy is made from the paper thesis. However if the fiche passes it is scanned using a Canon microfilm scanner in a batch format. Each page of the thesis is scanned as multiple BMP file and stored in one folder for each thesis. To maintain control the folders are named using .bnumbers from the library's Innovative Interfaces (III) catalogue. The .bnumber ties the digital file to the library catalogue MARC record and is unique.

The folders of BMP files are then converted to TIFF files. These files are then checked for quality and processed involving: erasure of signatures on approval pages to comply with Canadian privacy laws; cropping of pages using PhotoShop; re-scanning of pages to improve the quality. The files are then converted to PDF using Adobe Acrobat. To make them more useful, the PDF pages are then "captured" using Adobe Acrobat to make them keyword searchable. The students then create the metadata for each thesis by using cut and paste taking author, title and subjects from the library catalogue record. The PDF security measures are then put in place allowing users to view but not print or edit the documents. The final step at this stage is a quality control check confirming all pages are scanned, random quality check of pages, testing keyword search capability and insertion of grey scale images if necessary. If the scanning is required from the print version, the various steps are the same except that using the flatbed scanner, TIFF files can be created from the original scan bypassing the need to convert BMP files to TIFF. Otherwise the

processing, capturing, security control and quality assurance steps are identical to the fiche scanning process. The documents are now ready to be uploaded into the SFU Library's Institutional Repository.

The SFU Library is using DSpace for its institutional repository. Since the retrospective theses all have MARC records in the library catalogue these records are used as the metadata for the DSpace record for each thesis. Using a Perl script (marc2dspace.pl) the MARC records are imported into DSpace and attached to each PDF file. The files are linked together by the unique .bnumber from the MARC record. Using the DSpace import utility, the PDF file with metadata is imported into DSpace a nd put into the "Thesis, Dissertations and other Required Graduate Degree Ess ays" community. The items are searchable by single keyword from the title, author, and abstract. As well the community is browsable by title, author or date. Once the PDF is opened it is then keyword searchable using Acrobat.

The next step is to put the URL for the DSpace thesis back into the MARC record in the library catalogue. Again using the DSpace import utility a DSpace map file is create d taking the .bnumber and handles or locations from the DSpace record. Using another Perl script (updatethesesmarc.pl) brief MARC records consisting only of 035 (for .bnumber) and 856 (for URL) are created. These records can be overlaid onto the existing records in III since .bnumber overlays are reliable. Once set up these scripts can be run without human involvement [7].

2.8.2 CRL/LAMP Brazilian Government Serials Digitization Project

In 1994, the Andrew W. Mellon Foundation funded the Center for Research Libraries (CRL) and the Latin American Microfilm Project (LAMP) to conduct a

joint project to scan and index about 700,000 pages of microfilmed Brazilian Government Documents and then provide access to them over the Internet.

The source materials for this project were microfilms of inkprint, text based reports, with relatively few illustrations and little use of color.

The documents were scanned as page images, which are essentially digital black and white snapshots of each page. The files produced in the project therefore cannot be searched for specific words or phrases. Intellectual access, beyond the general level of the title of each digitized piece, has therefore relied on subject indexing. They have here experimented with searchable volume indexes produced by rekeying original tables of contents and indexes, and providing links to specific page images. They similarly rekeyed and linked a separate subject index to some of the source materials, employed image mapping to link some subject indexes to specific pages without rekeying, and explored other approaches to offset the limitations inherent in a database of page images.

In the final analysis, though, anyone with Internet access can now effectively access, search, and retrieve the entire contents of nearly 700,000 pages concerning Brazilian federal and state history. The project has successfully enhanced scholarly access to materials that were heretofore scarce, fragile, and widely scattered.

The Project relied on scanning to create digital images from analog images stored on microfilm. The process consisted of many steps, the first of which centered on defining our scanning procedures. Choosing image formats that could represent the microfilm images, and identifying the steps involved in scanning the microfilm and processing the images so that they could be indexed were part of this process. Once these procedures were established, the film was scanned by previewing the microfilm and then performing the scanning itself. Finally, the digital images were post-processed for retrieval and viewing over the Internet. Arranging the scanned

images into an ordered collection to facilitate user access was the most complex portion of the process [8].

2.8.2.1 Scanning Equipment and Processing

The scanner used for the Brazil Project was a SunRise Imaging SRI-50 Microfilm Scanner. The software used to run the scanner was ScscanTM, a DOS-based program that is now obsolete.

Scanning was accomplished by loading a roll of microfilm on the scanner, and adjusting the settings in accord with the condition of the microfilm images as determined during the preview process. These settings included an adjustable pull-down feature for the aperture to accommodate the varying frame sizes found in many rolls of film.

The scanner automatically lined up the film so that the camera could capture a 300-dpi TIFF image. The scanner could not be preset to manage automatically all of the problems that would lead to unacceptable page-images, so a PFA staff member had to view each image after it was loaded and make manual adjustments as necessary.

Once the page was scanned, the TIFF page-image was saved to a server to await post-processing [8].

2.8.2.2 Indexing the Document Collection

The Brazil Project ultimately utilized five different approaches to index the four image collections:

- A hypertext hierarchy was established to permit navigation between the four collections;
- A report-level access structure was designed and applied globally to all documents;
- The few tables of contents found in the collections were keyed and hyperlinked to their respective page-image GIF documents;
- Subject headings, created a controlled vocabulary to each of the 2,572 Provincial Presidential Reports;
- Image-mapping the Almanak's detailed subject indexes to link the citations directly to their respective page-images [8].

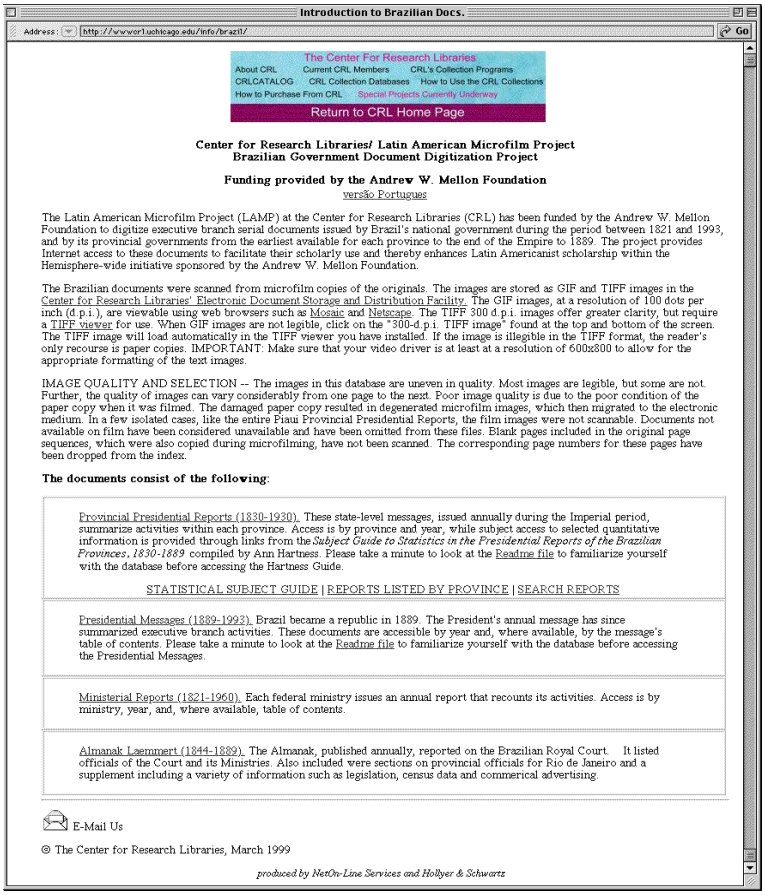

Introduction to Brazilian Docs.
Address: http://www.crl.uchicago.edu/info/brazil/
Go
The Center For Research Libraries
About CRL
Current CRL Members
CRL's Collection Programs
CRLCATALOG
CRL Collection Databases
How to Use the CRL Collections
How to Purchase From CRL
Special Projects Currently Underway
Return to CRL Home Page
Center for Research Libraries/ Latin American Microfilm Project
Brazilian Government Document Digitization Project
Funding provided by the Andrew W. Mellon Foundation
versão Portugues
The Latin American Microfilm Project (LAMP) at the Center for Research Libraries (CRL) has been funded by the Andrew W. Mellon Foundation to digitize executive branch serial documents issued by Brazil's national government during the period between 1821 and 1993, and by its provincial governments from the earliest available for each province to the end of the Empire to 1889. The project provides Internet access to these documents to facilitate their scholarly use and thereby enhances Latin Americanist scholarship within the Hemisphere-wide initiative sponsored by the Andrew W. Mellon Foundation.
The Brazilian documents were scanned from microfilm copies of the originals. The images are stored as GIF and TIFF images in the Center for Research Libraries' Electronic Document Storage and Distribution Facility. The GIF images, at a resolution of 100 dots per inch (d.p.i.), are viewable using web browsers such as Mosaic and Netscape. The TIFF 300 d.p.i. images offer greater clarity, but require a TIFF viewer for use. When GIF images are not legible, click on the "300-d p.i. TIFF image" found at the top and bottom of the screen. The TIFF image will load automatically in the TIFF viewer you have installed. If the image is illegible in the TIFF format, the reader's only recourse is paper copies. IMPORTANT: Make sure that your video driver is at least at a resolution of 600x800 to allow for the appropriate formatting of the text images.
IMAGE QUALITY AND SELECTION -- The images in this database are uneven in quality. Most images are legible, but some are not. Further, the quality of images can vary considerably from one page to the next. Poor image quality is due to the poor condition of the paper copy when it was filmed. The damaged paper copy resulted in degenerated microfilm images, which then migrated to the electronic medium. In a few isolated cases, like the entire Piaui Provincial Presidential Reports, the film images were not scannable. Documents not available on film have been considered unavailable and have been omitted from these files. Blank pages included in the original page sequences, which were also copied during microfilming, have not been scanned. The corresponding page numbers for these pages have been dropped from the index.
The documents consist of the following:
Provincial Presidential Reports (1830-1930). These state-level messages, issued annually during the Imperial period, summarize activities within each province. Access is by province and year, while subject access to selected quantitative information is provided through links from the Subject Guide to Statistics in the Presidential Reports of the Brazilian Provinces, 1830-1889 compiled by Ann Hartness. Please take a minute to look at the Readme file to familiarize yourself with the database before accessing the Hartness Guide.
STATISTICAL SUBJECT GUIDE | REPORTS LISTED BY PROVINCE | SEARCH REPORTS
Presidential Messages (1889-1993). Brazil became a republic in 1889. The President's annual message has since summarized executive branch activities. These documents are accessible by year and, where available, by the message's table of contents. Please take a minute to look at the Readme file to familiarize yourself with the database before accessing the Presidential Messages.
Ministerial Reports (1821-1960). Each federal ministry issues an annual report that recounts its activities. Access is by ministry, year, and, where available, table of contents.
Almanak Laemmert (1844-1889). The Almanak, published annually, reported on the Brazilian Royal Court. It listed officials of the Court and its Ministries. Also included were sections on provincial officials for Rio de Janeiro and a supplement including a variety of information such as legislation, census data and commerical advertising.
E-Mail Us
© The Center for Research Libraries, March 1999
produced by NetOn-Line Services and Hollyer & Schwartz

Figure 2.9 Project Website[http://www.crl.uchicago.edu/info/brazil]

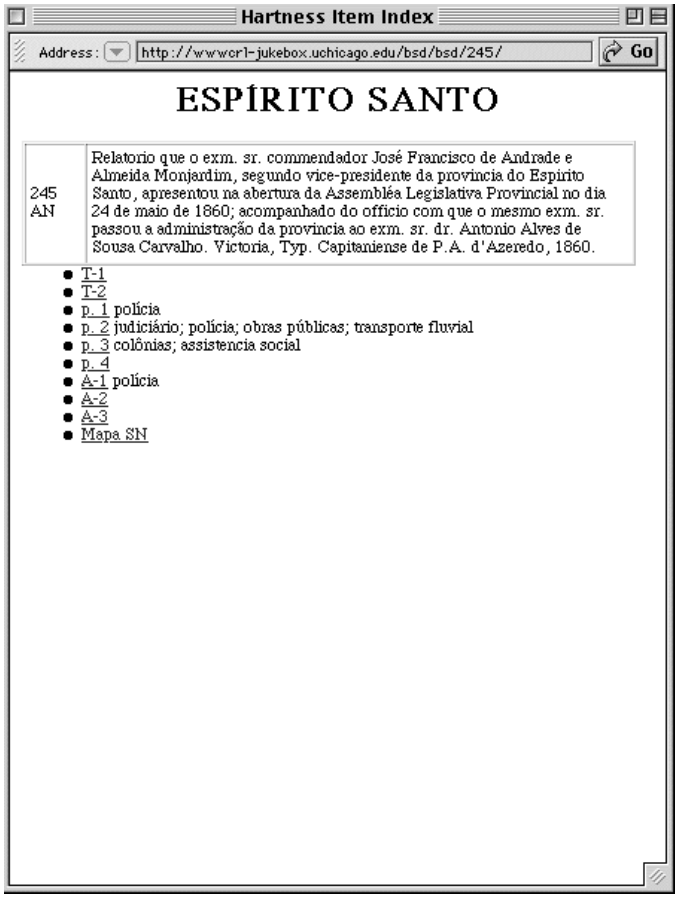

Hartness Item Index
Address: http://wwwcrl-jukebox.uchicago.edu/bsd/bsd/245/
Go
ESPÍRITO SANTO
245
AN
Relatorio que o exm. sr. commendador José Francisco de Andrade e Almeida Monjardim, segundo vice-presidente da provincia do Espirito Santo, apresentou na abertura da Assembléa Legislativa Provincial no dia 24 de maio de 1860; acompanhado do officio com que o mesmo exm. sr. passou a administração da provincia ao exm. sr. dr. Antonio Alves de Sousa Carvalho. Victoria, Typ. Capitaniense de P.A. d'Azeredo, 1860.
T-1
T-2
p. 1 polícia
p. 2 judiciário; polícia; obras públicas; transporte fluvial
p. 3 colônias; assistencia social
p. 4
A-1 polícia
A-2
A-3
Mapa SN

Figure 2.10 Pagination File 245

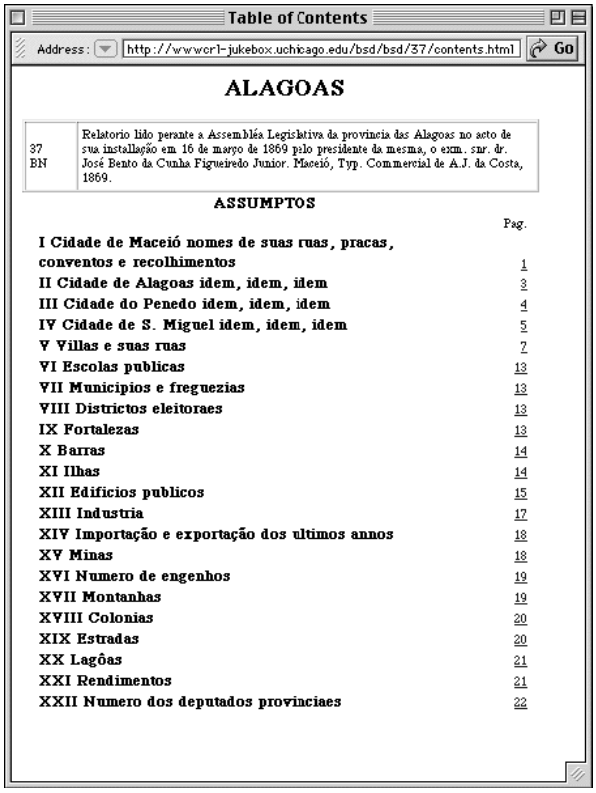


Table of Contents
Address: http://wwwcrl-jukebox.uchicago.edu/bsd/bsd/37/contents.html
Go
ALAGOAS
37
BN
Relatorio lido perante a Assembléa Legislativa da provincia das Alagoas no acto de sua installação em 16 de março de 1869 pelo presidente da mesma, o exm. snr. dr. José Bento da Cunha Figueiredo Junior. Maceió, Typ. Commercial de A.J. da Costa, 1869.
ASSUMPTOS
Pag.
I Cidade de Maceió nomes de suas ruas, pracas, conventos e recolhimentos 1
II Cidade de Alagoas idem, idem, idem 3
III Cidade do Penedo idem, idem, idem 4
IV Cidade de S. Miguel idem, idem, idem 5
V Villas e suas ruas 7
VI Escolas publicas 13
VII Municipios e freguezias 13
VIII Districtos eleitoraes 13
IX Fortalezas 13
X Barras 14
XI Ilhas 14
XII Edificios publicos 15
XIII Industria 17
XIV Importação e exportação dos ultimos annos 18
XV Minas 18
XVI Numero de engenhos 19
XVII Montanhas 19
XVIII Colonias 20
XIX Estradas 20
XX Lagôas 21
XXI Rendimentos 21
XXII Numero dos deputados provinciaes 22

Figure 2.11 Table of Contents

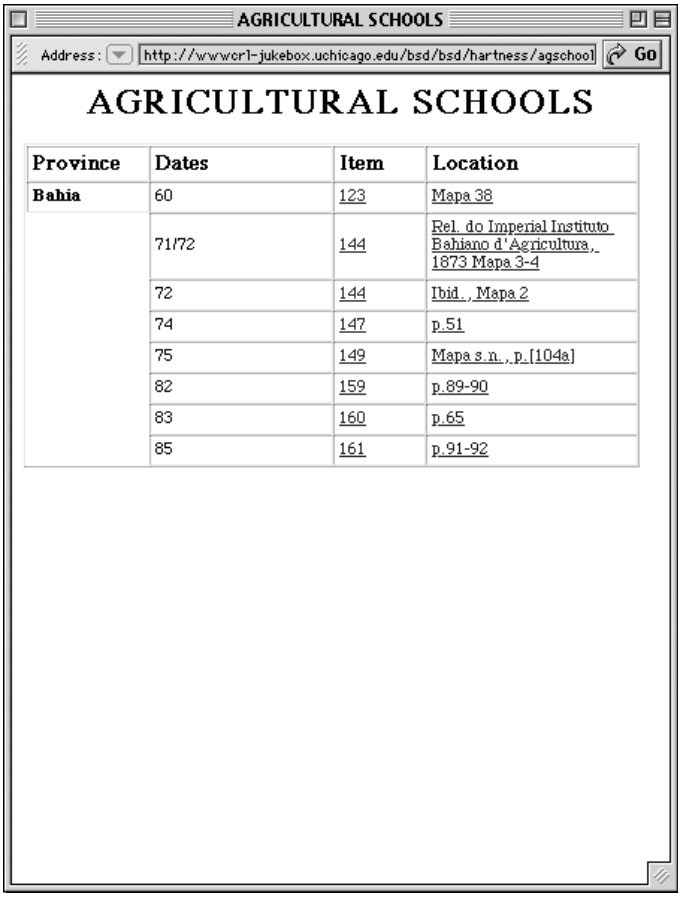


Figure 2.12 Subject headings

2.8.3 The Tundra Times Newspaper Digitization Project

This project is about the Tuzzy Consortium Library, a small regional library in a very remote location (Barrow, Alaska) successfully undertook the digitization of the *Tundra Times*, a statewide newspaper that documents the history of Alaska Native peoples and their political struggles from 1962 to 1997.

2.8.3.1 Digitization Process

In order to make a newspaper available for searching on the Internet, the following processes must take place: (1) the microfilm copy or paper original is scanned, (2) master and Web image files are generated, (3) metadata is assigned for each issue, page, and article to improve the searchability of the newspaper, (4) OCR software is run over high resolution images to create searchable fulltext, and (5) OCR text, images, and metadata are imported into a digital library software program.

They determined that the best approach for the *Tundra Times* project would be to outsource not only the scanning of the microfilm and generation of the derivative image files, but also the OCR processing and generation of XML files of the OCR text and metadata as these processes could be done more efficiently and less expensively by a service bureau [9].

2.8.3.2 Microfilm Scanning

Microfilm rolls are scanned in batches, as the technician completes a work unit. Each roll contains approximately 700 page images, which are scanned at 400 dpi (some earlier images were scanned at a lower resolution). The master image is a cropped, de-skewed, 8-bit grayscale TIFF master scan, averaging 34 MB.

iArchives, service bureau delivered three images derived from the 8-bit grayscale TIFF master scan: (1) 4-bit grayscale, 400dpi TIFF image (average file size 17 MB), (2) 125dpi, 8-bit TIFF images converted to JPEG page and article files for Web delivery (average file size 0.53 MB), and (3) JPEG thumbnails of full pages.

Their Web delivery format is Adobe's PDF Searchable Image file. Each PDF file comprises a JPEG image, OCR text, and select metadata and averages 0.56 MB per page. Adding the text to the PDF adds 3-8% to the file size ("noisy" images generate larger text files and are at the 8% end of the range). Each word is inserted into the file at offsets specified by the OCR text bounding box coordinates in the XML file. Newspaper articles can extend across several pages and all parts of an article are contained in a single PDF file. PDF Searchable Image files are viewable and searchable by Adobe's Acrobat Reader, a common plug-in that is well supported by Adobe. Packaging larger JPEG files within the PDF ensures the text can be read comfortably onscreen, even by users with visual disabilities (using the Reader's magnify/zoom option) [9].

2.8.3.3 Metadata

The archival technician assigns both page level and article level metadata. Each page image is tagged with the following metadata: (1) publication title, (2) publication date, (3) volume and issue number, and (4) page number. The page image is then segmented into articles and the following article level metadata is keyed: (1) headline, (2) byline, (3) classification, and (4) whether the article is a lead story [9].

2.8.3.4 OCR Processing

OCR is run on article images, or more precisely, on a number of rectangular regions that comprise an article. The resulting OCR text is assembled for each article as well as for the entire page. iArchives' OCR framework employs several of the best commercial OCR engines. The OCR framework assumes that errors made by different OCR engines are weakly correlated, thus, in cases where the OCR engines do not agree on the word found at a particular location (node), the result of each engine is preserved. This technique improves search recall over that of a single OCR engine, especially for low quality images [9].

2.8.3.5 Costs

Newspaper scanning and processing costs are detailed in Table 2.3 below.

Table 2.3 Per Page Digitization Costs

iArchives Scanning/page	iArchives Processing/page	Metadata Markup & Page Segmentation/page	Total Per Page
$0.15	$0.20	$1.70	$2.05

2.9 Microfilm Scanners

2.9.1 Canon Microfilm Scanner 800 MS800 SCSI Connection

Type: Desktop digital microfilm reader/scanner
Film Formats: Universal with interchangeable carriers
Film Types: Both negative and positive images of silver or diazo 16mm, 35mm film, aperture cards and microfiche

Image Scanning:

- Resolution: Up to 600 dots per inch
- Scan Modes: B/W, B/W Fine, B/W Photo, Grayscale up to 256 levels*
- Scan Sizes (US): 11” x 17”, 11” x 14”, 8-1/2” x 11”, 8-1/2” x 5-1/2”
- Scan Positions: Center, Left, Two consecutive pages
- Scan Speed: 3 Seconds 8-1/2” x 11”**
- 3.9 Seconds 11” x 17”**
- Scan Select: Trimming, Auto Border Erasure, Margin Setting
  Interface: SCSI II and Video I/F Standard

Standard Features:

- Auto Focus with Manual Override
- Automatic Exposure with Manual Override
- Motorized Zoom Lens with programmable memory keys
- Motorized Image Rotation with Auto Skew Correction and Automatic 90 Degree Rotation
- Automatic Bimode Sensing with Manual Override (N-P/P-P)
- Automatic Border Erasure
- Automatic Centering

Optics:

- Lens Magnifications: 7-7.5X, 9-16X, 14-30X, 20-50X, 57X
- Screen Size (H x W): 11-3/4” x 17” (300 mm x 435 mm)

Options:

- Interchangeable Carriers
- Remote Operation Keyboard
- Framing Kit for trimming function
- 128MB RAM
- Foot Switch (Scan/Print)
- Workstation IV

Electrical Requirements: 120V AC, 60Hz, 4.5A
Dimensions: (H x W x D): 24” x 30” x 24” (612 mm x 760 mm x 600mm)
Weight: 104 lb. (approx. 47kg)
Pice: $12,457.00 (Price includes delivery and installation)

*128mb RAM required
**Examples based on typical settings @ 200 dpi. Actual processing speeds may vary based on PC performance and application software [10].

Figure 2.13 Canon MS800 Microfilm scanner

2.9.2 ScanPro 1000 microfilm scanner

Features and Benefits:

- Compact, desktop operation, fits almost anywhere
- High resolution scan of your microfilm in just ONE second
- Single Zoom lenses cover 7X to 54X or 8X to 100X
- Real time viewing on any Windows compatible monitor
- Time saving automatic features such as brightness, contrast, focus, image straighting, and image cropping
- Use with All Microforms including fiche, ultra fiche, roll film, micro opaques, and aperture cards
- 360^0 Optical Image Rotation and Digital Rotation
- Scan, print, e-mail, save to USB, CD, and hard drive
- PDF,JPEG, TIFF, TIFF comp., TIFF G4, and Multipage
- Customizable toolbar for simple operation
- Save and restore settings provides flexibility and efficiency
- Secure screen mode for public use applications
- On screen help for convenience and ease-of-use

ScanPro 1000 Product Information:

SOFTWARE: PowerScan^{TM} , Auto-Scan^{TM} plug-in (optional).
SCANNING RESOLUTION: Selectable 150, 200, 250, 300, 400, 600.
ROLL FILM CONTROLS: Automatic framing, Automatic Image advance.
SCAN MODE: Grayscale, Halftone.
COMPATIBLE OPERATING SYSTEMS: Windows 2000, XP, Vista.
HARDWARE INTERFACE: FireWire IEEE 1394.
DIMENSIONS (H x W x L): 7.5” x 12” x 16” (190mm x 305mm x 406mm).
WEIGHT:19.5lbs. (9kg).
POWER: 100-240VAC 50/60Hz (automatic power save).
WARRANTY: 12 month factory warranty.

PRICE: $6,695.00 (Includes scanning software, firewire cable and interface card. Includes 7X-54X Zoom Lens and Microfiche/Aperture Card Film Carrier) [11]

Figure 2.14 ScanPro 1000 Microfilm scanner

2.9.3 SpeedScan 3 in 1 Microfilm Scanner

SpeedScan is the all encompassing scanning system. It allows users to scan and digitize any kind of film with the appropriate module (rollfilm, aperture card, and ultrafiche). The integrated computer uses Microsoft® Windows® XP Professional operating system. The graphic display interface to the SunRise scanners allows the use of a standard analog display. A 17” or larger display, with a minimum 1280 x 1024 resolution is recommended for best results [12].

Table 2.4 SpeedScan Hardware Specifications

Features	**3 in 1 SpeedScan**
3 in 1	V
Dual stream	V
True output resolution	V
Selectable camera resolution	V
Upgradeable	V

Module interchangeability	V
Remote access diagnostics	V
Software	
Operating System: Windows XP Pro	V
Applications:	
ScanFlo professional Included	Included
RowScan Optional	Included
ReelScan	Optional
Computing System	
Processor	Intel Core 2 Duo
DRAM	1 GB
Hard drive	SATA 160 GB
Optical drive: Dual layer DVD writer	V
Flash drive	V
Performance	
Rollfilm using ScanFlo	*200 ppm = (pages per minute)
Ultrafiche using ScanFlo	*80 ipm = (image per minute)
Aperture Card using ScanFlo	*600 cph = (cards per hour)

Rollfilm: 16mm, 200dpi, 24x reduction

Ultrafiche: 5 rows x14 images, 200dpi, 24x reduction

Aperture Card: Sizes 26.4”x15.9”, 200dpi, 8-bit grayscale, 24x reduction

Price: $45,000.00

Figure 2.15 SpeedScan 3 in 1 Microfilm Scanner

2.9.4 FlexScan 2 in 1 Scanner for Rollfilm and Microfiche

The FlexScan 2 in 1 scanner is designed to offer a complete package for users with rollfilm and microfiche scanning requirements on a limited budget.

FlexScan with NextStar can scan rollfilm up to 240 pages per minute or microfiche up to 125 images per minute. The NextStar software introduces an innovative, patented, new processing methodology for use with nextScan scanners. With NextStar, speed is measured by the amount of time required to scan an entire roll of film or jacket of fiche. For a full standard roll of film with office document images, at 200 DPI and 24X, FlexScan with NextStar can process the entire roll in 13 minutes, yielding a true speed of 240 ppm.

FlexScan uses superior camera technology that produces incredible speed, precision and uniform output. Scanned images are sharper with better edge definition because FlexScan uses fiberoptics as its light source, eliminating hot spots and uneven lighting.

FlexScan combined with the new NextStar software introduces an innovative processing methodology called Ribbon Scanning. An entire roll of film or jacket of microfiche is digitized from top-to-bottom and end-to-end in grayscale and stored as a single ribbon file.

Ribbon Scanning solves many of the challenges encountered today in the conversion process from microfilm or microfiche to digital images. NextStar software, with its innovative Ribbon Scanning, was designed to reduce conversion costs while boosting productivity. NextStar allows the user to verify that all images were properly captured, and identifies any image detection or density problems. NextStar then allows the operator to correct those issues in a post-scan audit

environment. NextStar eliminates the need for rescans resulting from density or frame detection problems, maximizing scanner utilization and productivity. With NextStar's superior image quality, handling any density and filming related issues commonly faced in conversion processes is easy, outputting images that actually match your database.

NextStar enables the user to manage the end-to-end conversion process. It is modular and expandable. From basic set-ups where all components run on the FlexScan Scanner, to large distributed production systems, the software components communicate between multiple platforms and work is scheduled and shared between many operators [12].

NextStar's unique features are:

- Reliability, no images are lost during scanning
- Automatic film classification and frame detection
- Post-Scan frame detection allowing correction by audit operator of any errors before output
- Re-audit / QA capability
- Individual frame-by-frame image processing options if needed
- Insert/Delete frames or images while maintaining file naming conventions
- Automatic lamp & gamma adjustment during setup and scanning

Table 2.5 FlexScan w/NextStar Specifications

SPEED – Rollfilm &*Fiche	**SOFTWARE – NextStar (Scan, Detect, Audit, Output)**	**OPTICS/CAMERA**
Roll: 240 PPM (based on a roll at 200DPI and 24x reduction)	Automatic lamp & gamma adjustment during setup and operation	Linear light via fiber optics yields flat illumination source
Fiche: 125 IPM		10 bit antiblooming CCD array to protect against over exposure
		8192 Pixel CCD
		7000 Scan lines per second

(based on fiche at 200DPI and 24x reduction) **OPTIONAL – Preconfigured Ribbon Storage Device (RSD) for simultaneous capture and output** Maximize throughput speed and productivity Available in 4, 8 and 16TB configurations	Rotate, mirror, crop, deskew, despeckle and edge enhancement filters Industry leading auto thresholding for bitonal images Independent image processing filters for each output image Multi image output in different formats Original optical resolution or interpolated (thumb-nails) Tri level blip detection and naming Flexible file naming and index file generation Standalone or domain workflow End-to-end management and reporting	**Operating Systems:** Windows XP Professional Latest Intel CPU Speeds Large SATA II hard drive 1 GB Network Interface 2 GB RAM (4 GB optional) **Film and Fiche Polarities:** positive and negative **Reduction Ratio:** 7x to 72x **Resolution:** 100-600 dpi **Document Sizes:** to E-size drawings at 200 dpi and oversize documents like oil well logs and EKGs (Image must fit in memory, 2 GB max image size) **Film and Fiche Size:** 16 & 35 mm, *Standard and Jumbo **Film and Fiche Orientation:** Comic, Cine **Fiche Formats:** Step & Repeat, Film Jackets, AB Dick, Microx, COM **Film and Fiche Types:** Vesicular, Blue and Black Diazo, Silver, Duplex, Duo, Blipped/Unblipped **File formats:** TIFF monochrome, TIFF uncompressed, Multi Page TIFF, TIFF Group IV, GPEG, CALS, PDF and JPEG 2ooo

Figure 2.16 FlexScan 2 in 1 Microfilm Scanner

2.10 Chapter summary

This part of project is done by collecting some information from internet, books and white papers. In this chapter I touched on such topics as Digital Library, Document Management, Archival System, Micrographics and Digital Imaging. Good understanding for each field is very important in order to develop effective web-based Document Management System.

CHAPTER III

PROJECT METHODOLOGY

3.1 Introduction

This chapter discusses the methodology of the project that will be applied through out the project. This methodology will discuss the system development tools & techniques and also the object oriented approach.

To develop the prototype of Digital Library System, the Object Oriented Approach has been selected. In this chapter, the requirement of hardware and software also discussed.

Data for the research were collected through interview and observation.

3.2 Project Methodology

Project methodology is a guideline to ensure that all project activities is well prepared. By the implementation of some methodologies, programs, documents, and data can be achieved as a result of activities and task that are included in the methodology.

3.2.1 Initial Planning Phase

In this phase the title of the project is discussed with supervisor. This phase also includes propose a topic and propose a project proposal. The objective of project development is analyzed and defined based on the problem statement.

3.2.2 Analysis Phase

In this phase it should be determined who will use the system, what the system should do, and where it will be used. This phase has three steps: study current system, literature review, data collection and data analysis.

3.2.2.1 Study Current System

The objective of this stage is to conduct a preliminary analysis about current system problems, propose solutions and describe benefits of new system. The main point in this stage is an understanding the as-is system.

3.2.2.2 Literature Review

Literature review is done by reading articles, web sites, reference materials. Also during this stage other microfilm digitization project are studied and analyzed. The aim of this stage is to extend theoretical knowledge in the field of subject studied.

3.2.2.3 Data Collection and Data Analysis

The objectives of this stage are to gather data, analyze the data and write a report. In gathering the data, there are a handful of tools such as document analysis, interviews and observation.

Personal interview was chosen as the data collection instrument to understand as-is system. A set of the interview questions is enclosed in **APPENDIX B**.

The data analysis of this phase was done through the analysis on information gathered from interview results and observations.

3.2.3 Microfilm Digitization

3.2.3.1 Scanning Process

The scanning process will be done by using the FlexScan 2 in 1 microfilm scanner designed to scan both rollfilm and microfiche. FlexScan with NextStar software can scan rollfilm up to 240 pages per minute or microfiche up to 125 images per minute.

FlexScan uses superior camera technology that produces incredible speed, precision and uniform output. Scanned images are sharper with better edge definition because FlexScan uses fiberoptics as its light source, eliminating hot spots and uneven lighting.

Scanning was accomplished by loading a roll of microfilm on the scanner, and adjusting the settings in accord with the condition of the microfilm images as determined during the preview process. All microfilms will be scanned in grayscale format.

Students can perform an initial physical scan of rollfilm to review that the quality is appropriate if an abundance of pictures, graphs exists that may not scan

well. If rollfilm passes this step it is then scanned using FlexScan microfilm scanner in a batch format. Each page of thesis is scanned as TIFF file and stored in one folder for each thesis. The folders are named using microfilm running number from the PSZ Library Catalogue System.

After scanning is done each batch of TIFF images will be processed by using ABBY FineReader 9.0 optical character recognition software. After loading the batch of TIFF images into ABBY FineReader software tool the next step is to start background recognition by selecting *Start Background Recognition* option from *Process* menu. Figure 3.1 below illustrates this process.

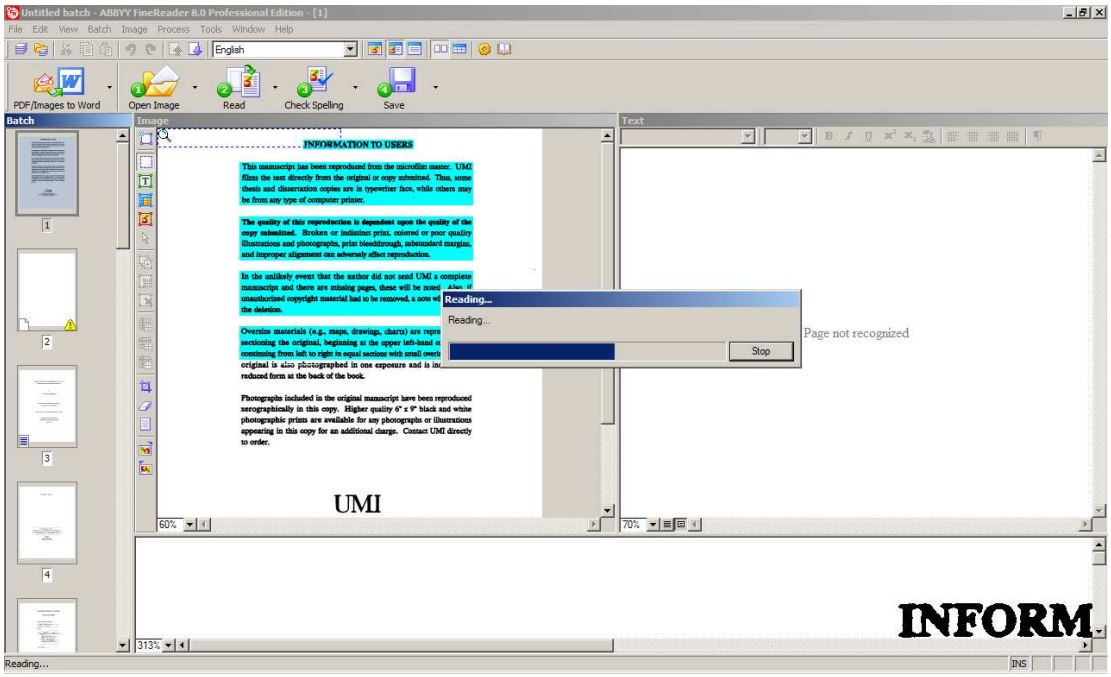


Figure 3.1 Background Recognition process

3.2.3.2 Cataloging and Indexing of Scanned Microfilms

Metadata is very important not only for users of the library, but also for library staff, because it helps manage the collection. Information such as title, author, and subject is created to assist the user in finding and identifying a resource. Other metadata, such as technical properties of a digital object, is created to assist library staff in managing that resource. Therefore it is very important that each scanned thesis has to have its own metadata.

The proposed system for Digital Library requires that each document (scanned microfilm thesis) have at least an author, title, and date of publication listed in the metadata, and it will also display (and search on) an abstract found there.

Since PSZ Library Catalogue System already has some metadata for each microfilm thesis we can easily get this metadata by requesting a MARC record from PSZ OPAC System and extracting the metadata values from it. From the OPAC System students who will help to do this work can extract such metadata as title, author, publisher, subjects, call number, and microfilm running number.

As long as PSZ Library does not include abstracts for any theses, so the metadata files do not have abstracts. The abstract will be extracted during OCR Processing by using ABBY FineReader 9.0 software.

Figure 3.2 illustrates the process of extracting metadata (Abstract field) from TIFF image using ABBY FineReader 9.0 OCR software.

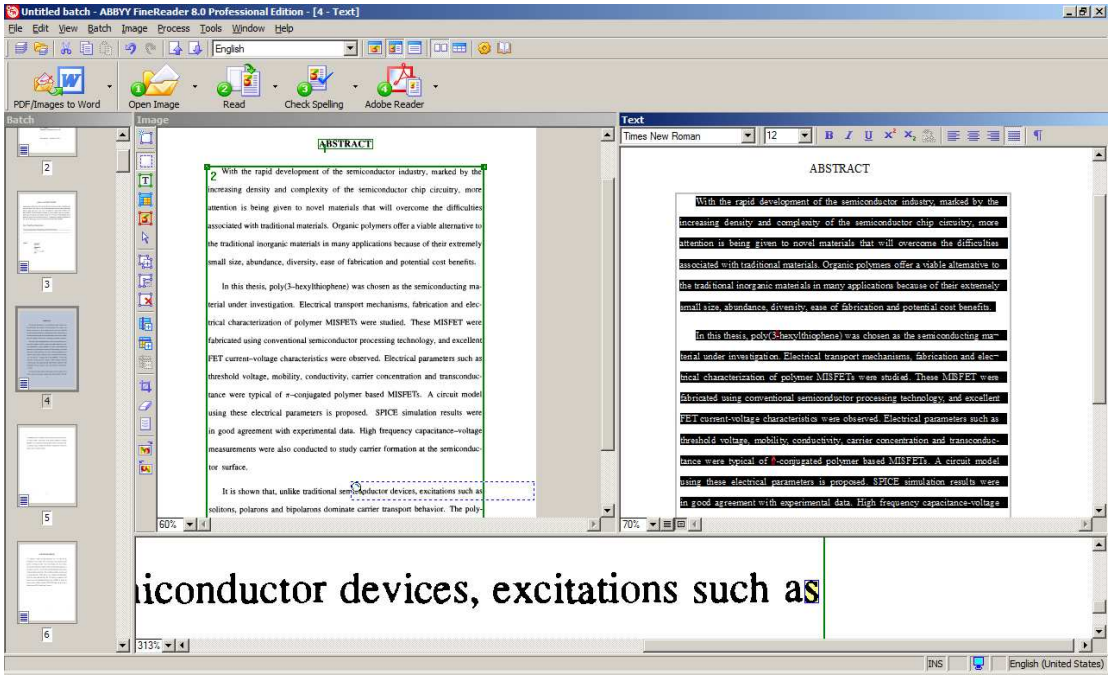

Untitled batch - ABBYY FineReader 8.0 Professional Edition - [4 - Text]
File Edit View Batch Image Process Tools Window Help
English
PDF/Images to Word
Open Image
Read
Check Spelling
Adobe Reader
Batch
Image
Text
Times New Roman
12
ABSTRACT
With the rapid development of the semiconductor industry, marked by the increasing density and complexity of the semiconductor chip circuitry, more attention is being given to novel materials that will overcome the difficulties associated with traditional materials. Organic polymers offer a viable alternative to the traditional inorganic materials in many applications because of their extremely small size, abundance, diversity, ease of fabrication and potential cost benefits.
In this thesis, poly(3-hexylthiophene) was chosen as the semiconducting material under investigation. Electrical transport mechanisms, fabrication and electrical characterization of polymer MISFETs were studied. These MISFET were fabricated using conventional semiconductor processing technology, and excellent FET current-voltage characteristics were observed. Electrical parameters such as threshold voltage, mobility, conductivity, carrier concentration and transconductance were typical of π-conjugated polymer based MISFETs. A circuit model using these electrical parameters is proposed. SPICE simulation results were in good agreement with experimental data. High frequency capacitance-voltage measurements were also conducted to study carrier formation at the semiconductor surface.
It is shown that, unlike traditional semiconductor devices, excitations such as solitons, polarons and bipolarons dominate carrier transport behavior. The poly-
iconductor devices, excitations such as
60%
70%
313%
INS
English (United States)

Figure 3.2 OCR Processing

The proposed system will also have three kind of metadata: faculty, deposited by (here we will show the librarian name, who added these theses into the database), deposited on (deposited day).

All metadata with scanned theses will be stored externally in a database. It provides more flexibility in managing, using, transforming it and also supports multi-user access to the data, advanced indexing, sorting, filtering, and quering.

The web delivery format for Document Management and Filing Archival System is PDF Searchable Image file. To create these files we are using OCR Processing tool ABBY FineReader 9.0. Figure 3.3 shows the PDF file saving mode. To create Searchable Image file it is recommended to select *Text under the page image* mode. After that in *Security Panel* the PDF security measures are then put in place allowing users to view but not print or edit documents. You can see these security measures from figure 3.4.

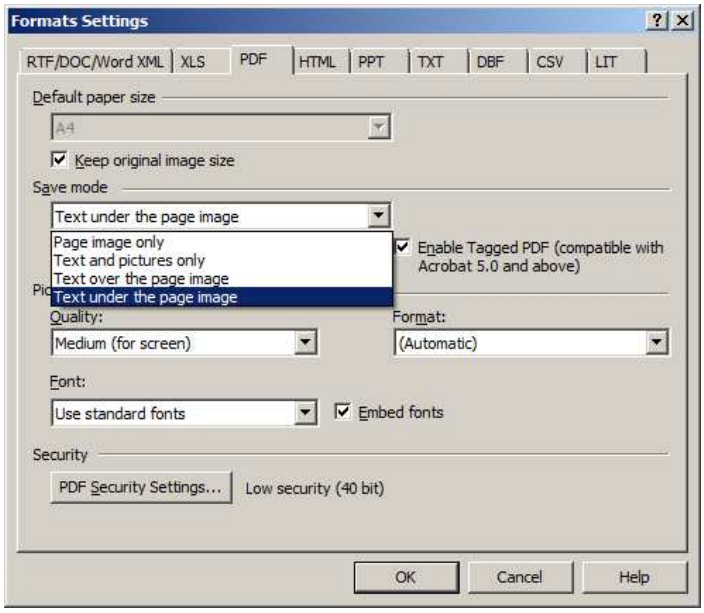


Figure 3.3 PDF saving options

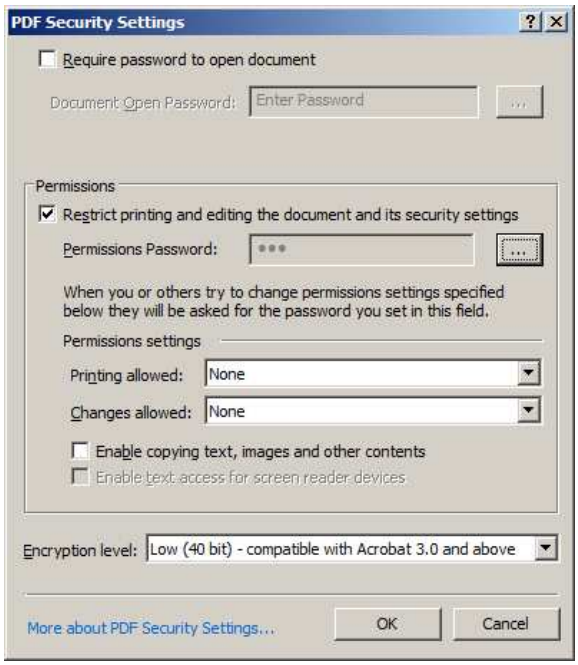

PDF Security Settings
Require password to open document
Document Open Password:
Enter Password
Permissions
Restrict printing and editing the document and its security settings
Permissions Password:
When you or others try to change permissions settings specified below they will be asked for the password you set in this field.
Permissions settings
Printing allowed:
None
Changes allowed:
None
Enable copying text, images and other contents
Enable text access for screen reader devices
Encryption level:
Low (40 bit) - compatible with Acrobat 3.0 and above
More about PDF Security Settings...
OK
Cancel

Figure 3.4 PDF Security Settings

3.2.4 Design

In this stage, system's interfaces for the prototype are designed. Besides that, database design for the system by graphically represents the organizational data also been done.

3.2.5 Implementation

After prototype is done, it will be implemented and tested by end users.

Table 3.1 Detail every phase in project Methodology Framework

Phase	Activities	Task	Deliverables
Planning	**1. Project Initiation** Identify and select projects.	1. Discuss with supervisor and choose an appropriate project title. 2. Project Designing Destination Management System has been chosen. 3. Identify background problem of current system 4. Determine project scope, objective and importance. 5. Produce the work plan to schedule the project using Gantt Chart	1. Project objective 2. Project scope 3. Project methodology 4. Project proposal 5. Project schedule
Analysis	**1. Study Current System** **2. Literature Review**	1. Identify procedures, processes 2. Identify problem with current system 3. Identify the common features required by library's user 4. Develop a list to-be features 5. Transform analysis data and models in Object Oriented method using UML 6. Produce Use Case Diagram, Class Diagram, and Sequence by using UML 7. Understand system interface issues	1. Literature Review Report 2. Initial Findings Report

	3. Data Collection and Data Analysis	8. Identify and study the user interface to design system	
Microfilm Digitization	**1. Scanning process** **2. Cataloging and Indexing Scanned Microfilms**	1. Scan sample theses stored on microfilm by using the FlexScan 2 in 1 microfilm scanner 2. Process scanned images by using ABBY FineReader 9.0 OCR software to extract metadata 3. Extract metadata from scanned images	1. Batch of TIFF images 2. Digitized retrospective theses in PDF Searchable Image file format
Design	**1. Identify system requirement** **2. Prototype Development**	1. Identify the hardware and software needed to design the system 2. Identify the system requirements 3. Design the Architecture 4. Database design 5. Review the user requirements 6. Design documentation the system	1. Conceptual design 2. System prototype
Implementation	**1. Prototype Implementation** **2. Applications Testing** **3. User Acceptance**	1. Using PHP and Java programming languages to implement the analysis and designs 2. Discuss with user and test the system 3. Install the to-be system	1. Implementation report 2. User manual

3.3 System development methodology

For developing the project the iterative and incremental software development process framework is chosen because of its object-oriented approach, also this framework undergoes continuous testing and refinement throughout the life of the project.

3.3.1 The Unified Process

The Unified Process is a specific methodology that maps out when and how to use the various UML techniques for object-oriented analysis and design (Alan Dennis et al., 2006). The UML provides structural support for developing the structure and behavior of an information system, the unified process provides the behavioral support.

The Unified Process is:

- Iterative and incremental
- Use case driven
- Architecture-centric

Inception Phase

Inception is the smallest phase in the project, and ideally it should be quite short. If the Inception Phase is long then it is usually an indication of excessive up-front specification, which is contrary to the spirit of the Unified Process.

The main goal of this phase is define the scope of the project and develop business case.

Elaboration Phase

The analysis and design workflows are the primary focus during this phase. By the end of the Elaboration phase the system architecture must have stabilized and the executable architecture baseline must demonstrate that the architecture will support the key system functionality and exhibit the right behavior in terms of performance, scalability and cost.

Construction Phase

Construction is the largest phase in the project. In this phase the remainder of the system is built on the foundation laid in Elaboration. System features are implemented in a series of short, timeboxed iterations. Each iteration results in an

executable release of the software. It is customary to write full text use cases during the construction phase and each one becomes the start of a new iteration. Common UML (Unified Modelling Language) diagrams used during this phase include Activity, Sequence, Colaboration, State (Transition) and Interaction Overview diagrams.

Transition Phase

The final project phase is Transition. In this phase the system is deployed to the target users. Feedback received from an initial release (or initial releases) may result in further refinements to be incorporated over the course of several Transition phase iterations. The Transition phase also includes system conversions and user training.

3.3.2 Object Oriented Approach

On of the main principles in the object oriented (OO) approach is that of abstraction, not of data structures and processes separately but both together. An object is a set of data structures and the methods or operations needed to access those structures.

Compared to the structured approach, the object-oriented is more data-centric - it evolves around class models. In the analysis phase, classes do not need to have

operations defined-only attributes. The growing significance of use cases in UML shifts the emphasis slightly from data to functions (Maciaszek, 2001).

3.3.3 UML Notation

The system development phase of the project framework is used UML (Unified Modelling Language) method to develop the system. The Unified Modeling Language (UML) is a language for specifying, visualizing, constructing and documenting the artifacts of a software-intensive system. UML provides diagrams that can be used to develop a system. They are (Rational, 1998):

- Class diagrams - describe classes and their inter-relationships
- Object diagrams - describe objects
- State diagrams - describe states and state transitions
- Component diagrams - describe useful groupings of an information base
- Deployment diagrams - shows system topology
- Use case diagrams - describe how an object is to be used
- Activity diagrams - show the work involved in performing an operation by an object
- Sequence diagrams - describe sequences of events
- Collaboration diagrams - describe sequences of events

3.4 System Requirement Analysis

Some hardware, software, network are required to support the project development and execution efficiently, systematically, and effectively.

3.4.1 Hardware Requirements

Hardware justification is a basic necessity which needed in developing a system. The hardware is included input and output devices, storage devices and data processor. The identified hardware which is needed in this system development is as below:

1. Personal computer with Intel Pentium 4
2. 512 MB RAM
3. Hard disk with 60 GB capacity
4. Microfilm scanner
5. Monitor
6. Printer
7. Network card or modem
8. FlexScan 2 in 1 Scanner for Rollfilm and Microfiche

3.4.2 Software Requirements

The proposed solution to develop the system was discussed in this section The programming languages used is PHP and Java, the development software is Adobe Dreamweaver SC3, the database used is MySQL and the CASE tool used is Rational Rose.

Table 3.2 Software required developing the system

Software	Purpose
1. Microsoft Project 2003	Microsoft project used to generate Gantt chart that used as a tool to schedule the project development
2. Microsoft Office Visio 2003	Microsoft Visio is used to draw diagrams. Example: Use case diagram, Class diagram, Sequence diagram and etc.
3. Adobe Photoshop 7.0	This software is used to create and edit images.
4. Adobe Dreamweaver	This software is used to program and develop the system
5. Microsoft SQL Server 7.0	SQL server is used to develop the database for the system
6. ABBYY FineReader 9.0 Professional	Optical Character Recognition software that delivers superior OCR and PDF conversion capabilities. This software is used to process batch of TIFF images (scanned microfilms) to create PDF Searchable Image files
7. Adobe Dreamweaver CS3	This software is used to develop the system prototype
8. XAMPP web server	XAMPP is an easy to install Apache distribution containing MySQL, PHP and Perl

3.5 Project Schedule

There are two phases were conducted for fulfillment of project 1 that are project planning, project analysis phase. The remaining phases will be proceeding for fulfillment of project 2. Therefore, all the activities involved during project 1 were shown in Gantt Chart as **APPENDIX A.**

3.6 Chapter summary

In this chapter we have identified the project development methodology and methods or approaches to develop the system. The flow of development activities through the SDLC has been highlighted. The project schedule is also has been elucidated in this chapter. The chapter laid down the methodology on how this project will be conducted and how to systematically pursue and achieve the research objectives.

CHAPTER IV

SYSTEM DESIGN

4.1 Organizational analysis

4.1.1 Introduction

Perpustakaan Sultanah Zanariah (PSZ) occupies a central location at the Universiti Teknologi Malaysia (UTM) main campus in Skudai. It has a branch at the UTM *City Campus*, Kuala Lumpur and also branches at several faculties, learning centres and Centres of Excellence. PSZ was officiated by Her Majesty Sultanah Zanariah, the Chancellor of University Teknologi Malaysia on 3rd February 1991.

The library is a four-storey building with a seating capacity of 3,422 and a collection of nearly half a million volumes. It has a total of 179 staff.

The process of library automation at PSZ started in 1986. Today most of the library's operations and services are computerised. All processes including materials acquisition, indexing, circulation and information searching are conducted through the Computerised Library System known as INFOLAN2.

4.1.1.1 Mission & Goals

• Vision Statement

- To be the knowledge centre of excellence in science and technology

• Mission Statement

- To contribute to the enhancement of knowledge through easy access, dissemination and sharing of resources in science and technology

• Objectives

- To provide information based services for its users
- To manage information in line with the learning, teaching, research, consultancy, and publication of the university
- To promote information services to UTM's internal and external community
- To nurture a knowledge-based culture and towards excellence mindset amongst UTM's internal and external community

4.1.2 Structure

The Organizational chart of Perpustakaan Sultanah Zanariah is given in **APPENDIX C**

4.1.3 Functions

As an integral component of the academic programme, PSZ supports the university's teaching, learning, research, consultancy and publication activities. Its services and collection development activities are geared towards fulfilling the need for library materials and information in the university's core area of Science and Technology. Nevertheless, PSZ also has a good Humanities and Social Science collection to support courses in these areas which are offered by several faculties.

Apart from information search of printed materials, other facilities available to library patrons include electronic information search through CD-ROM databases as well as online searches. With the advancement in Internet technology, PSZ has made these facilities accessible via personal computers (PC), Multimedia, VCD and laser discs are also available to library patrons for teaching, learning, research, consultancy and publication activities.

4.1.4 Problem statement in the organizational context

As the basic medium of long-term preservation of important information the library uses microfilms. The huge archive of microfilms is stored in library, at the same time access to the information stored in this archive is very complicated. There is not enough microfilm reader in library by means of which it is possible to view microfilms. The process of microfilm retrieval is done manually and takes much time. If user wants to view microfilm he should write the running number of this microfilm then go to media counter officer, give him this number, and wait while librarian is searching for this appropriate microfilm.

Also the preservation cost of microfilms in Malaysia is very high because of high natural humidity; librarians are constantly struggle with the high humidity in storage vault.

But the main disadvantage of using microfilm nowadays is that they do not support simultaneous access of several users.

4.1.5 Case study

4.1.5.1 Introduction

There is a big archive of microfilms in Sultanah Zanariah library. Almost 70 % it consists of the theses written by students and teachers of university. The main objective of using microfilms is preservation, therefore the majority of microfilms is

stored in a negative format. The others 30 % of archive occupied by articles, cuttings of newspapers and the works of other authors bought by university.

The process of searching and retrieval of information from microfilms takes considerable time. At first the user of library through OPAC system enters UTM Special Collections section, types query, then from the list of the appeared documents chooses necessary one and writes down it call number or running number of microfilm and goes into the media room. Then media room officer goes to the archive vault and takes appropriate roll film. After that he inserts the roll film into microfilm reader machine. There is 5 or 6 thesis in one roll film that is why the process of finding appropriate title is difficult; users have to do it manually.

Figure 4.1 Microfilm reader machine

4.1.5.2 The process of filming and storing of microfilms in Sultanah Zanariah Library

The process of filming in library consists of several steps. Theses are arrived to the laboratory in hard copy. At the first stage these theses are unbound and heaped one by one in a pile then the filming of these theses is started. After that the film is processed by a microfilm processor. At this stage the ready negative of a microfilm turns out. Right at the end the microfilm is checked on presence of defects and absent pictures. Then the microfilm is assigned by running number. Figures 4.2 – 4.5 below illustrate the process of filming procedures.

Figure 4.2 The process of thesis unbinding

Figure 4.3 The process of filming pages by Planetary Microfilming camera

Figure 4.4 Microfilm processor

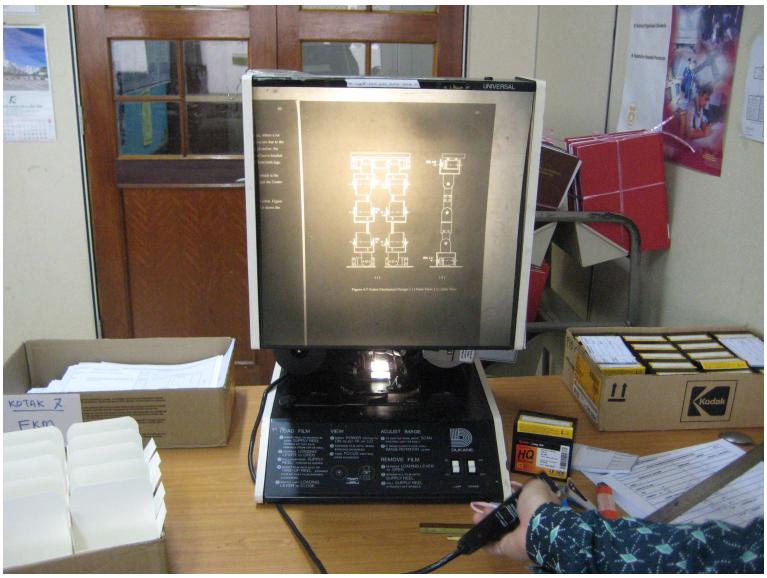


Figure 4.5 The process of checking microfilm

Storage of microfilms is made in a special archive vault. There is the special temperature of 18 Celsius with relative humidity 55 % in it, air conditioners are in dry mode is supported. To struggle with the raised humidity in archive vault librarians using special equipment to burn liquid in air, also they put bags with silica gel inside of shelves which absorb moisture.

Figure 4.6 Microfilm archive vault

Figure 4.7 Silica gel inside of shelves

4.2 As-Is Process and Data Model

All the activities and processes that involve in existing system have been modeled using Use Case Diagram, Sequence Diagram and Activity Diagram. Data that involve in each process or activity is illustrated using Sequence Diagram.

4.2.1 Use Case Diagram

Figure 4.8 shows Use Case diagram that illustrates the process of searching, viewing microfilm by library users in Sultanah Zanariah Library.

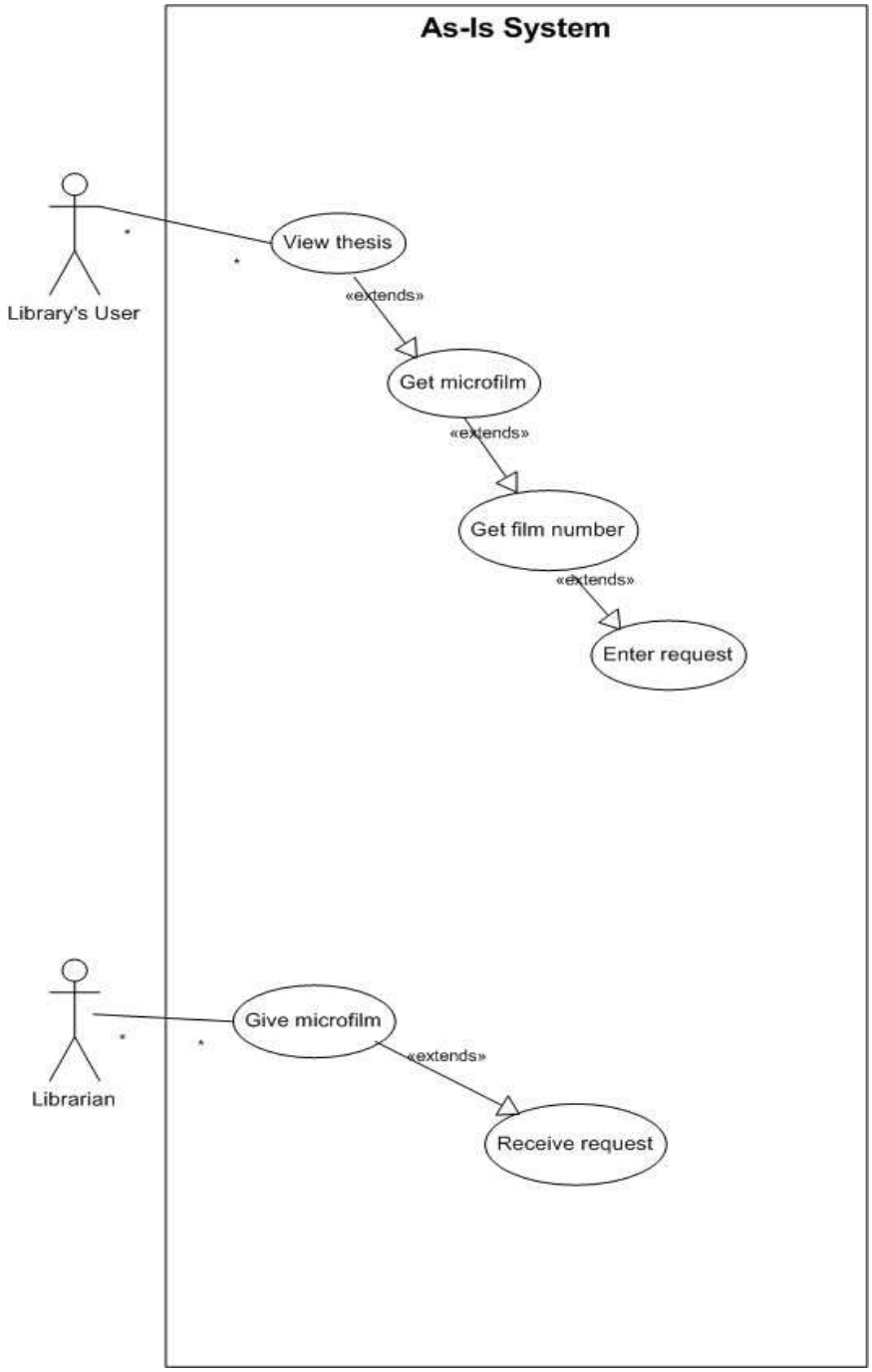


Figure 4.8 Use Case Diagram for As-Is System

4.2.2 Use Case Description

Use case description is explanation of each use case that involve in use case diagram that showed in Figure 4.8. Use Case description is created based on activities that involve in each use case.

There are four use case descriptions. Table 4.1, 4.2, 4.3, and 4.4 shows the use case description for each use case.

Table 4.1 Use Case Description for Enter request

Use case name: **Enter request**	ID: **1**	Importance Level: **High**
Primary Actor: **Library's User**		Use case Type: **Detail, essential**
Stakeholders and interests: **User - want to find some thesis**		
Brief Description: **This use case describes how users could find information about thesis such as thesis call number.**		
Trigger: The user enters to the **INFOLAN** website Type: External		
Relationships: Association: User Include: Extend: Generalization:		
Normal Flow of Events: 1. User type library's website address 2. User gets to main page of library web site 3. User press on INFOLAN hyperlink 4. User gets to INFOLAN 5. User press "UTM Special Collections" link		
Subflows:		
Alternate/Exceptional Flows:		

Table 4.2 Use Case Description for Get microfilm call number

Use case name: **Get microfilm call number**	ID: **2**	Importance Level: **High**
Primary Actor: **Library's User**	Use case Type: **Detail, essential**	
Stakeholders and interests: **User - want to know the running number (call number) of microfilm on which the looked thesis is storing**		
Brief Description: **This use case describes how users could find information about thesis such as thesis call number.**		
Trigger: The user enters to the "UTM Special Collections" Type: External		
Relationships: Association: User Include: Extend: Generalization:		
Normal Flow of Events: 1. User enter request on "UTM Special Collections" 2. User select appropriate thesis from list of thesises 3. User write the call number of microfilm on which appropriate thesis is storing		
Subflows:		
Alternate/Exceptional Flows:		

Table 4.3 Use Case Description for Get microfilm

Use case name: **Get microfilm**	ID: **3**	Importance Level: **High**
Primary Actor: **Library's User, Librarian(media counter officer)**		Use case Type: **Detail, essential**
Stakeholders and interests: **User - want to get appropriate microfilm** **Librarian – should find the microfilm in archive vault**		
Brief Description: **This use case describes the process of getting microfilm by**		

library's user
Trigger: The user get microfilm call number Type: External
Relationships: Association: Include: Get microfilm call number Extend: Generalization:
Normal Flow of Events: 1. User come to media counter officer (librarian) 2. User ask to find appropriate microfilm (roll film) 3. Media counter officer go to archive vault and search for microfilm 4. Media counter officer bring the appropriate microfilm
Subflows:
Alternate/Exceptional Flows:

Table 4.4 Use Case Description for View thesis

Use case name: **View thesis**	ID: **4**	Importance Level: **High**
Primary Actor: **Library's User**		Use case Type: **Detail, essential**
Stakeholders and interests: **User - want to get information from thesis on microfilm**		
Brief Description: **This use case describes how user is getting information from thesis by viewing and reading thesis.**		
Trigger: The user get the microfilm Type: External		
Relationships: Association: User Include: Get microfilm Extend: Generalization:		

Normal Flow of Events: 1. User receive the microfilm 2. User insert the microfilm into microfilm reader machine 3. User read the thesis by changing the microfilm images
Subflows:
Alternate/Exceptional Flows:

4.2.3 Sequence Diagram

The sequence diagram is a dynamic model that illustrates the classes that participate in a use case and messages that pass between them over time (Dennis et al., 2005).

Figure 4.9 and Figure 4.10 are the sequence diagrams of the selected use case that illustrate the processes of viewing thesis by library's user and giving microfilm to user by librarian.

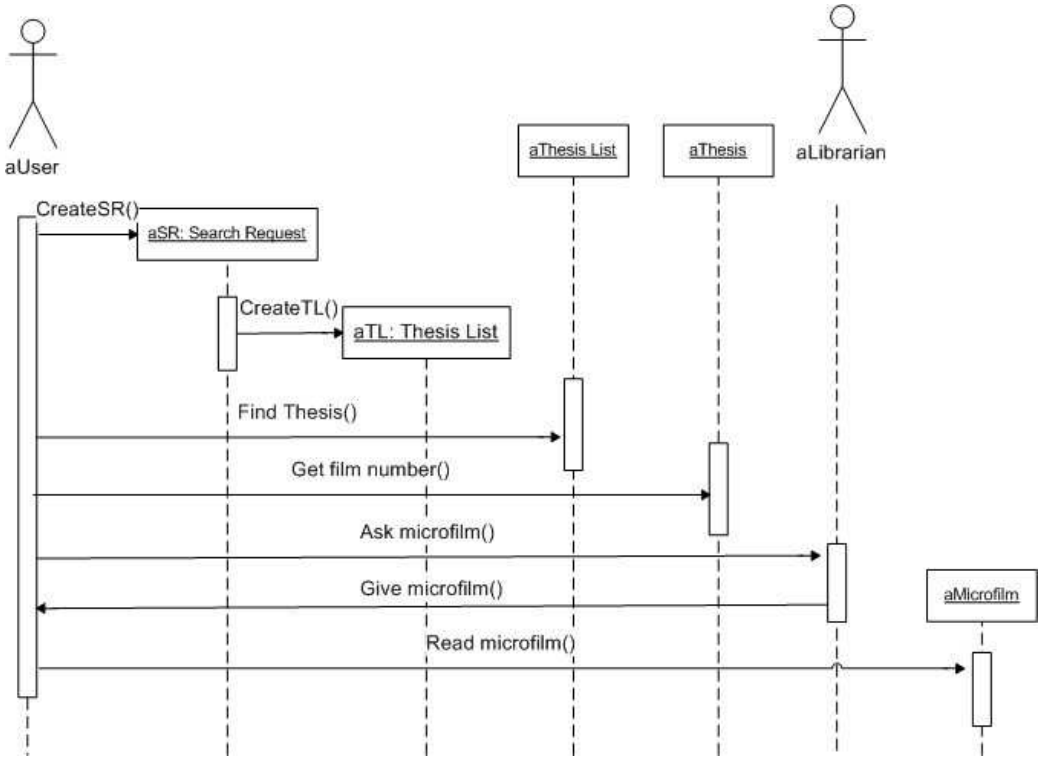


Figure 4.9 Sequence Diagram for View thesis

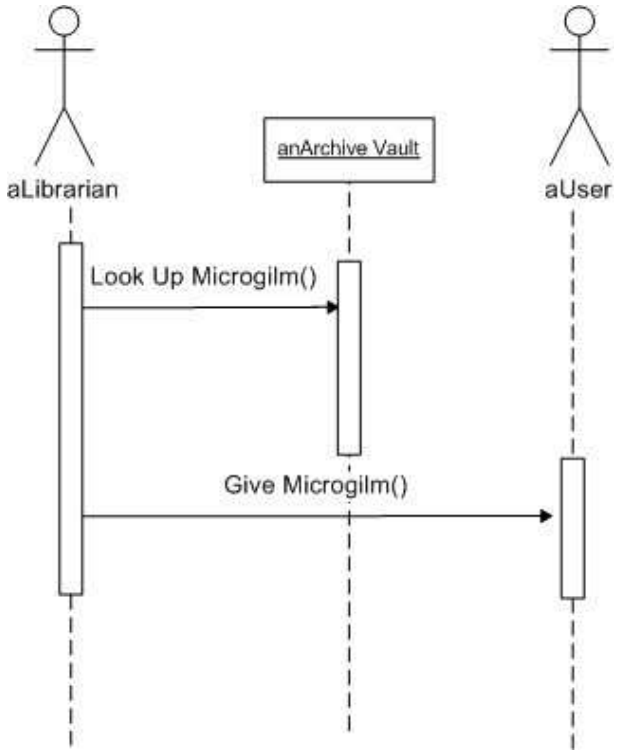


Figure 4.10 Sequence Diagram for Give microfilm

4.2.4 Activity Diagram

Activity diagrams portray the primary activities and the relationships among the activities in a process.

Figure 4.11 shows the Activity Diagram for process of viewing thesis.

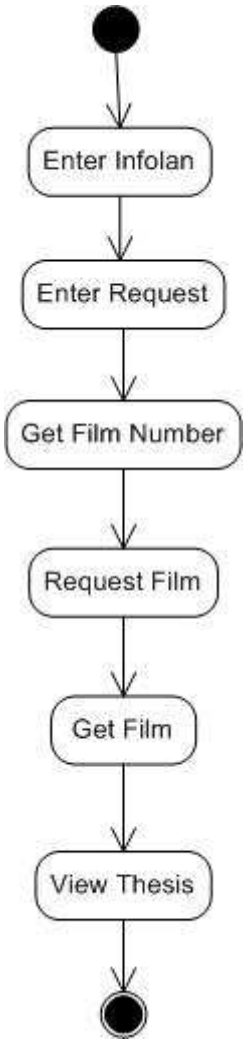


Figure 4.11 Activity Diagram for current process

4.3 To-Be Process and Data Model

Document Management and Filing Archival System is such system that will store on its database the digitized microfilm collection. The functionality of this system will be based on functional and non-functional requirements gathered from librarians and users to meet their needs. Users will access this system to search, view, and retrieve the sought-for information using their computers and mobile devices.

4.3.1 Use Case Diagram

Figure 4.12 shows Use Case diagram for Filing and Archival System.

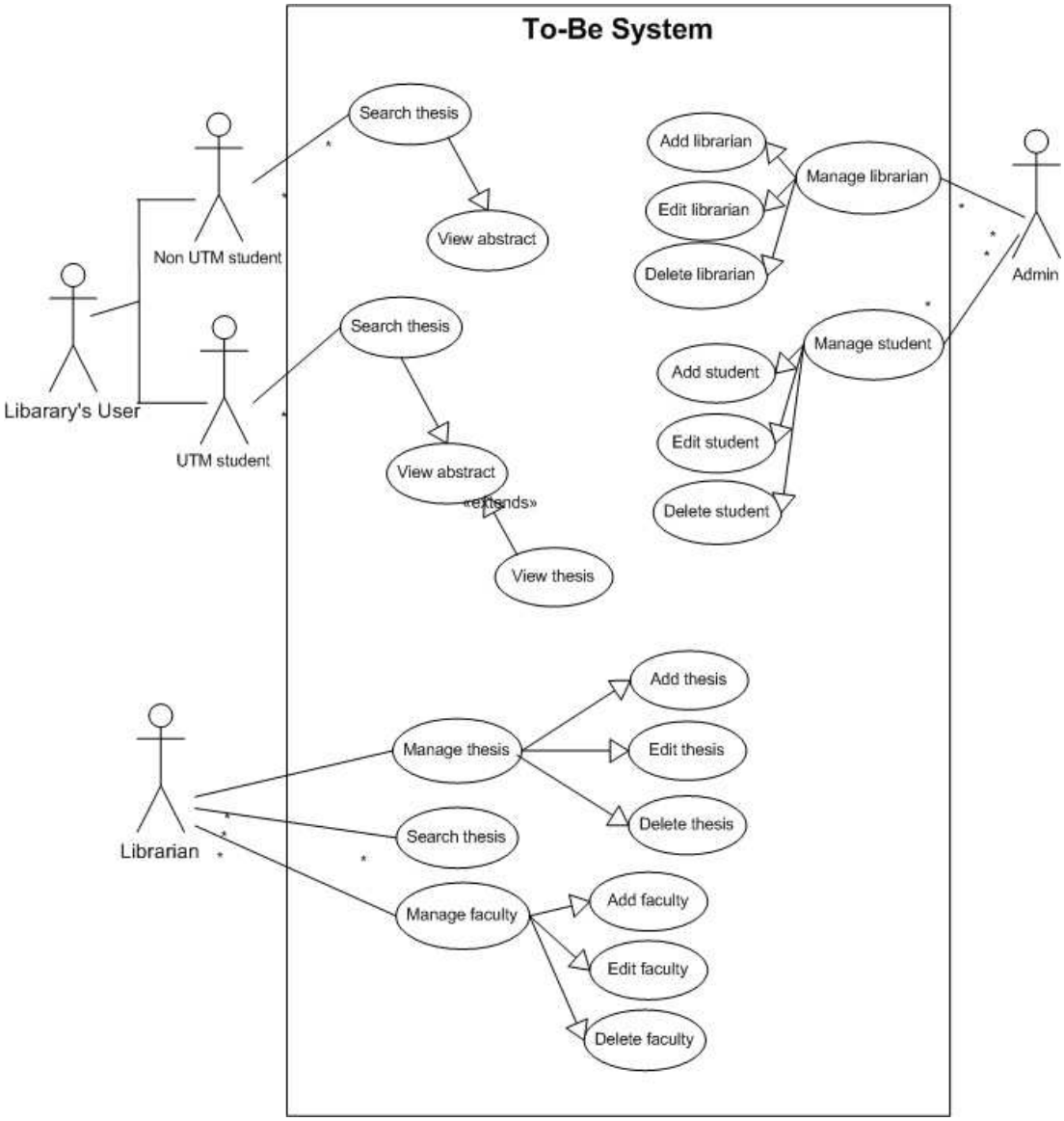


Figure 4.12 Use Case Diagram for To-Be System

4.3.2 Use Case Description

Use Case description is created based on use cases in use case diagram. There are six use cases that involve in MIS. Table 4.5, 4.6, 4.7 shows the use case description for each use case associated with library's user.

Table 4.5 Use Case Description for Search thesis

Use case name: **Search thesis**	ID: **1**	Importance Level: **High**
Primary Actor: **Library's User**		Use case Type: **Detail, essential**
Stakeholders and interests: **User - want to find appropriate thesis to read**		
Brief Description: **This use case describes how user can find the appropriate thesis**		
Trigger: The user enter the Digital Library web site Type: External		
Relationships: Association: User Include: Extend: Generalization:		
Normal Flow of Events: 1. User enter the Digital Library web site 2. User enter request in search field and press ENTER button		
Subflows:		
Alternate/Exceptional Flows:		

Table 4.6 Use Case Description for Get list of theses

Use case name: **Get list of theses**	ID: **2**	Importance Level: **High**
Primary Actor: **Library's User**		Use case Type: **Detail, essential**
Stakeholders and interests: **User - want to select the thesis from list**		
Brief Description: **This use case describes how user is selecting the thesis from list of theses**		
Trigger: The user press ENTER button after he has typed the query. Type: External		

Relationships: Association: Include: Search thesis Extend: Generalization:
Normal Flow of Events: 1. User enter request in search field of site and pressed ENTER button
Subflows:
Alternate/Exceptional Flows:

Table 4.7 Use Case Description for View thesis

Use case name: **View thesis**	ID: 3	Importance Level: **High**
Primary Actor: **Library's User**		Use case Type: **Detail, essential**
Stakeholders and interests: **User - want to view appropriate thesis**		
Brief Description: **This use case describes how user is selecting the thesis from list of thesises**		
Trigger: The user select the thesis from list and from overview page of this thesis he press "View in pdf format" link Type: External		
Relationships: Association: Library's User Include: Get list of thesises Extend: Generalization:		
Normal Flow of Events: 1. User select the thesis from list 2. User enter overview page of this thesis 3. User press the "View full version in pdf format" link		
Subflows:		
Alternate/Exceptional Flows:		

4.3.3 Class Diagram

Figure 4.13 shows Class Diagram for proposed system.

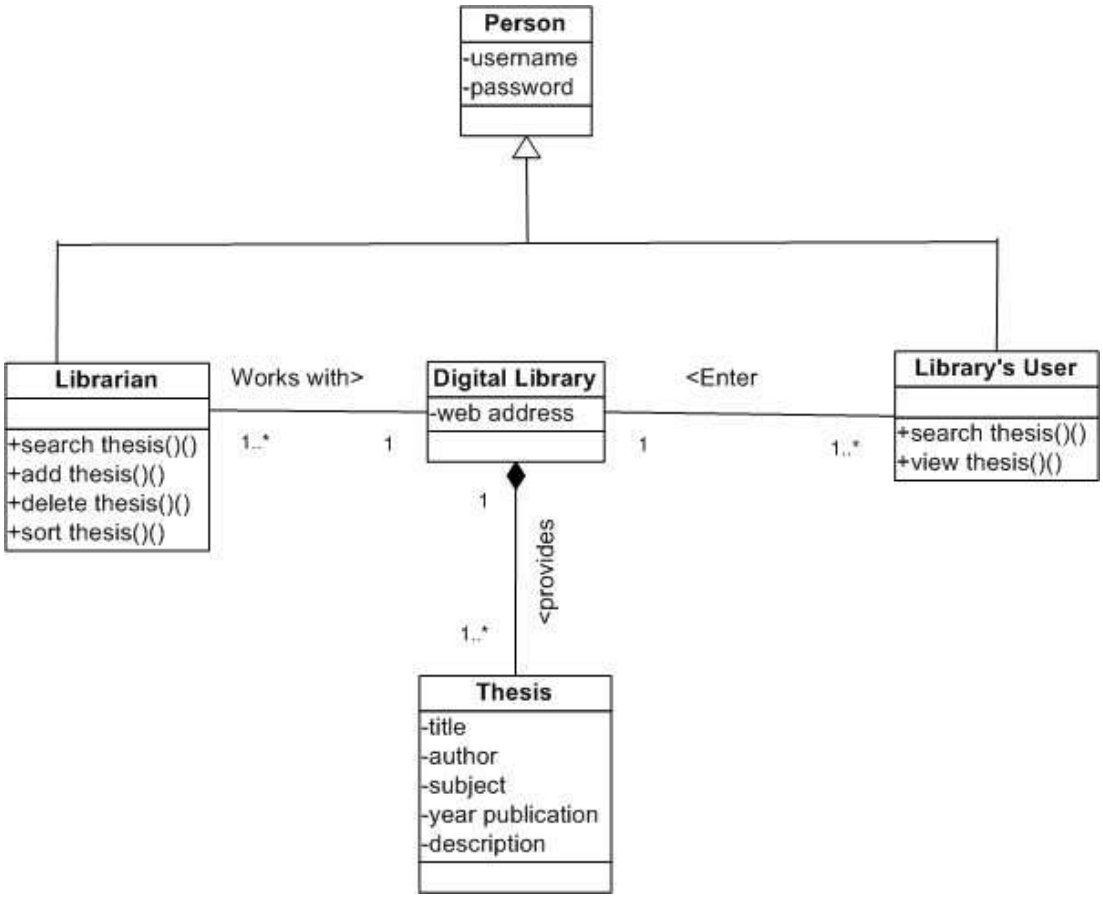


Figure 4.13 Class Diagram

4.3.4 Sequence Diagram

Sequence diagram is developed to show the interaction that involve in Filing and Archival System. Figure 4.14 illustrates how users of library interacts with new system

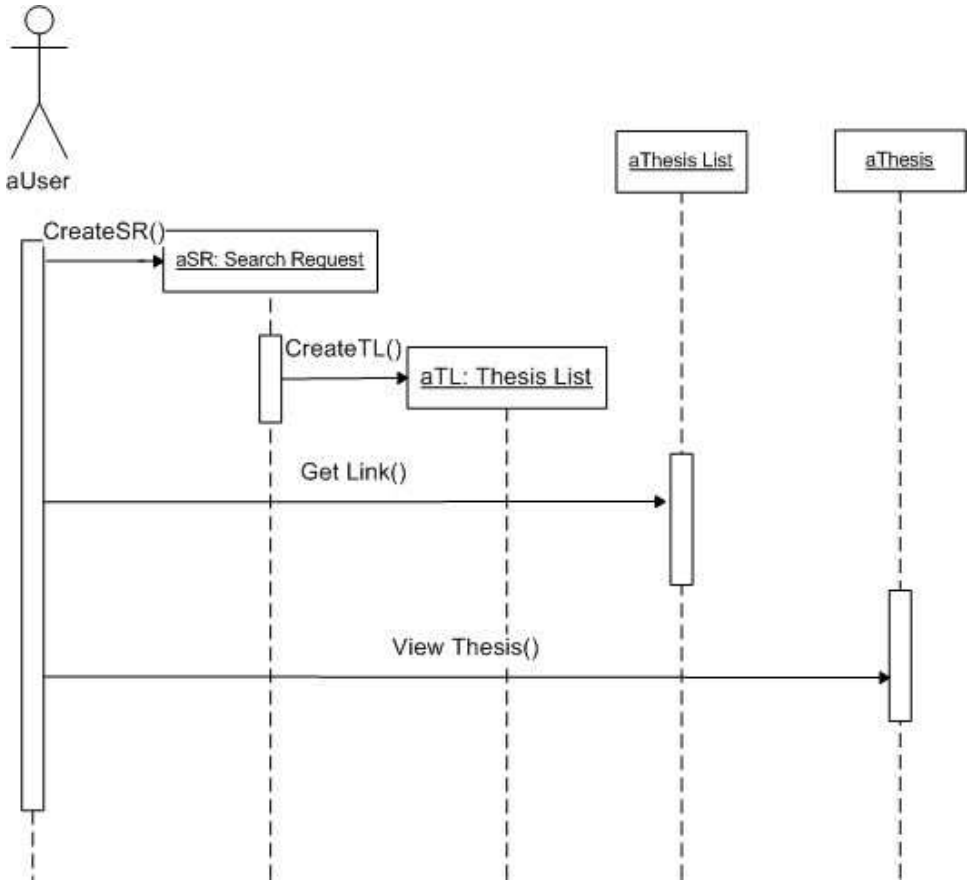


Figure 4.14 Sequence Diagram for User of proposed system

4.3.5 Activity Diagram

Figure 4.15 illustrates the Activity Diagram that portrays the primary activities and the relationships among the activities in a process of viewing, searching theses in new system

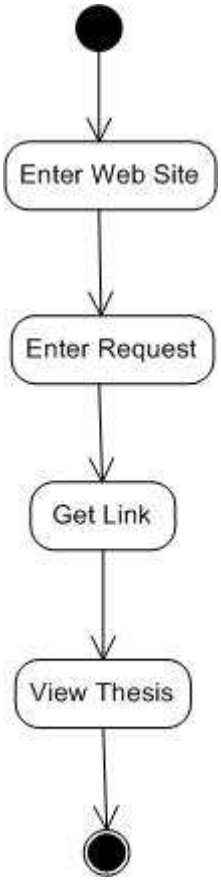


Figure 4.15 Activity Diagram for proposed system

4.4 System Architecture

A digital library consists of many computers united by communications network. The dominant network is the Internet, the emergence of which as a flexible, low-cost, world-wide network has been a major factor in the growth of digital libraries.

Figure 4.16 shows some of the computers that are used in digital libraries. They have three main functions: to help users interact with the library, to store collections of materials, and to provide services.

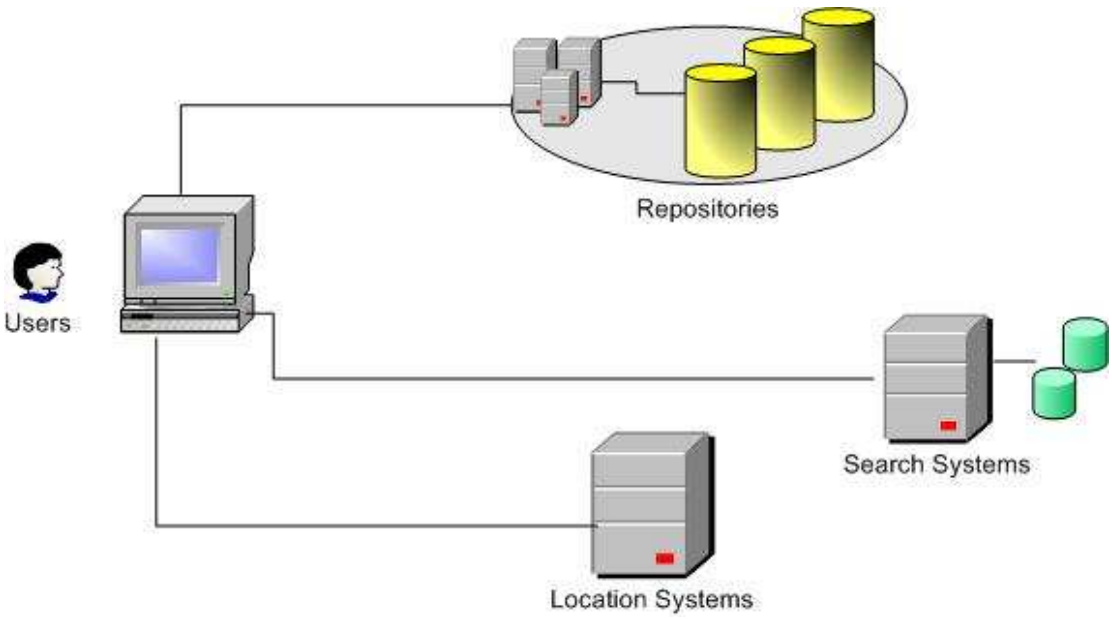


Figure 4.16 Digital Library Network

A computer used to access a digital library is called a *client.* Sometimes clients may interact with a digital library without the involvement of a human user. Among the clients that do this are robots that automatically index library collections and sensors that gather data about weather and supply it to digital libraries.

Repositories are computers that store collections of information and provide access to them. An *archive* is a repository that is organized for long-term preservation of materials.

Two typical *services* provided by digital libraries are *search services* and *location services*. Search services provide catalogs, indexes, and other services to help users find information. Location services are used to identify and locate information.

The generic term *server* is used to describe any computer other than a client. A single server may provide several of the functions listed above, perhaps acting as a repository, a search service, and location service.

System Architecture for proposed system is shown in Figure 4.17. The system is using *three-tiered client/server architecture*. A current practice is to create client-server architectures using *thin-clients* because there is less overhead and maintenance in supporting thin-client applications.

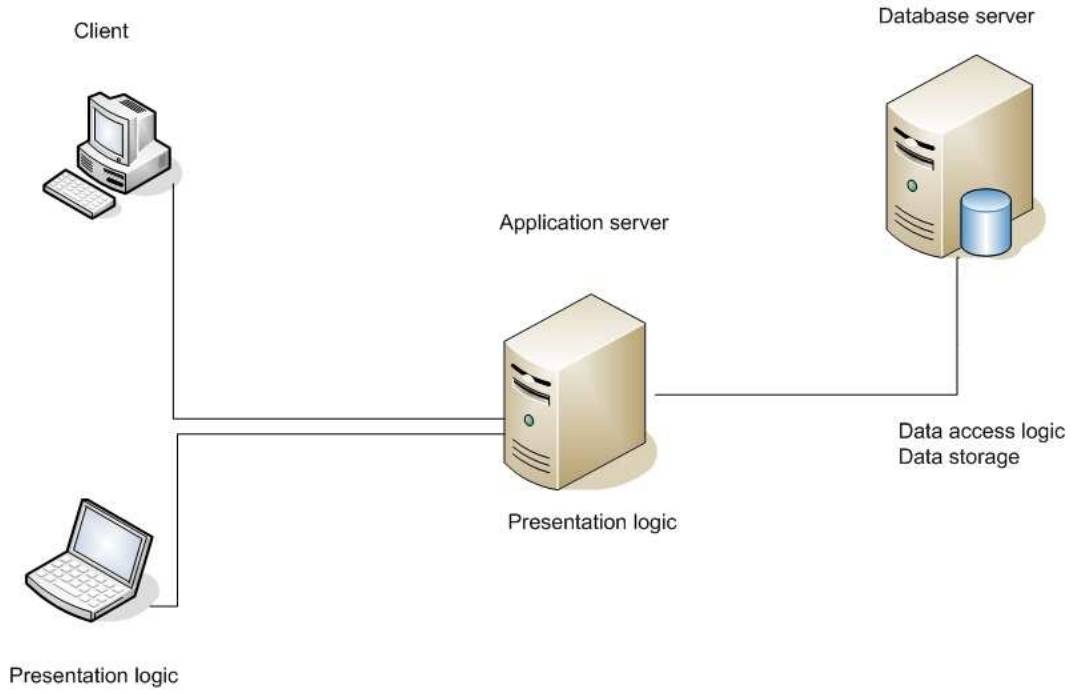


Figure 4.17 System Architecture

A *three-tiered architecture* uses the three sets of computers. The client responsible for presentation, a database server(s) is responsible for the data access logic and data storage, and the application logic is spread across two or more different sets of servers. Client is using Web browser to access the system and enter commands. Web server responds to the user's requests, either by providing (HTML) pages and graphics or by sending the request to the third component on another application server that perform various functions (application logic).

4.5 Physical Design

4.5.1 Database Design

A database for the Web-based Document Management and Filing Archival System has been designed using MySQL relational database management system. The database consists of 5 tables as illustrated in Table 4.8 below. Please refer **Appendix D** to view the database design.

Table 4.8 Database design for the Web-based Document Management and Filing Archival System

No.	Table Name	Table Description
1.	Admin	This table contains information about Administrator (name, username, password)
2.	Faculty	This table keeps a list of faculties of UTM
3.	Librarians	This table contains information about librarians of PSZ (name, username, password)
4.	Students	This table contains information about students of UTM
5.	Thesis	This table contains detailed information about digitized thesis such as title, author, publisher etc.

Database design includes design of tables to keep data for achieving and updating in fast and an easier way. Relationships between tables also must be defined. Class diagram is used as a guide for designing a database. Normalization also needed to get consistency of the data in the table. Database design for proposed system is shown in Figure 4.18.

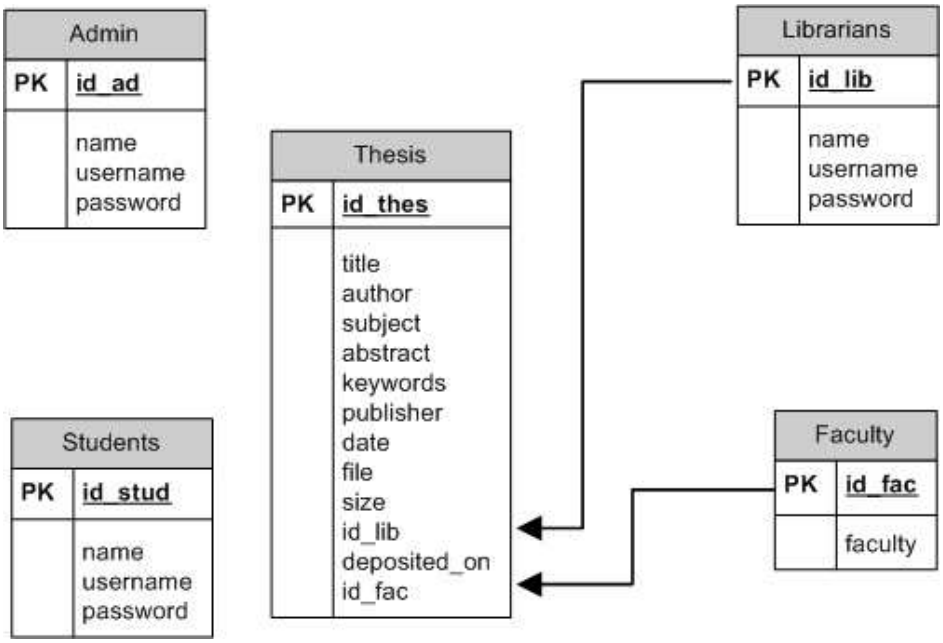


Figure 4.18 Database Design

4.5.2 Program (Structure) Chart

The program (structure) chart of the proposed Web-based Document Management and Filing Archival System has been modeled using the UML approach under the use case diagram. The chart comprises of four different actors which are non UTM students who can visit the site, students of UTM, librarians of PSZ and the administrator. Each actor is related to more than one use cases relevant to their involvement in the proposed system. For further illustration, the reader can refer to Figure 4.12 Use Case Diagram for the Web-based Document Management and Filing Archival System on page 87.

4.5.3 Interface Chart

Figure 4.19 on page below illustrates the interface chart for the Web-based Document Management and Filing Archival System. There are four categories of users for proposed system which are UTM students, non UTM students, librarians, and administrator.

Non UTM students are allowed to access browse by faculty, browse by title, browse by author, and browse by date pages. They also can search theses and view search result page but they can not view or download the whole thesis, only abstract. UTM students in addition to the options mentioned above can view or download the entire thesis.

Librarians can access librarian page, where they can enter manage thesis page and manage faculty page.

Administrator has the right to enter administrator page, where he can enter manage student and manage librarian pages.

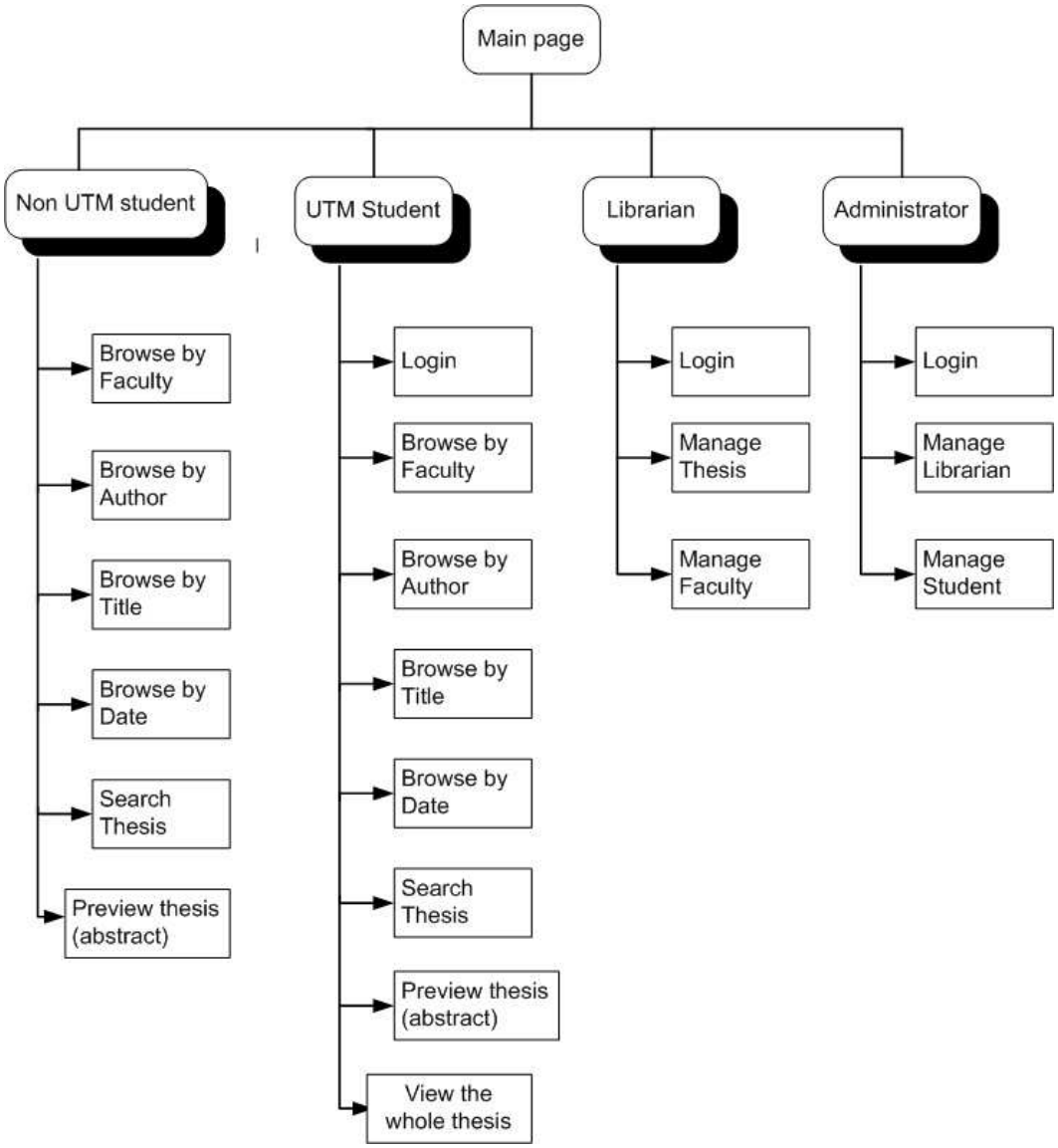


Figure 4.19 Interface Chart

4.5.4 Detailed Modules/Features

The Web-based Document Management and Filing Archival System consist of four modules; each of them has its own features and capabilities. Below are descriptions of each module:

- Library's Users

a) UTM student module

Access to this module can be obtained only after user authentication. This module serves in order to students can search, view theses digitized from microfilms. An access for the theses is restricted to UTM students and staff only, which means that only this category of users can view or download the whole thesis. This module offers students the opportunity for simple and advanced search, as well students can browse the collection of digital theses by title, author, faculty, and date.

Figure 4.20 Main page of Student Module

b) General page

This module serves for all categories of users. It has almost the same features as in the previous module, except the users of this module can not view or download the whole version of theses, only preview mode (abstract only).

- Library's Staff

  a) Administrator module

To avoid data loss and data modification without permission, only the authorized staff is allowed to login to this module using their own unique username and password. This module allows the administrator to manage library's users, where he or she can add, edit, delete librarian or student. Also administrator can make the back up copy of database to avoid any data loss.

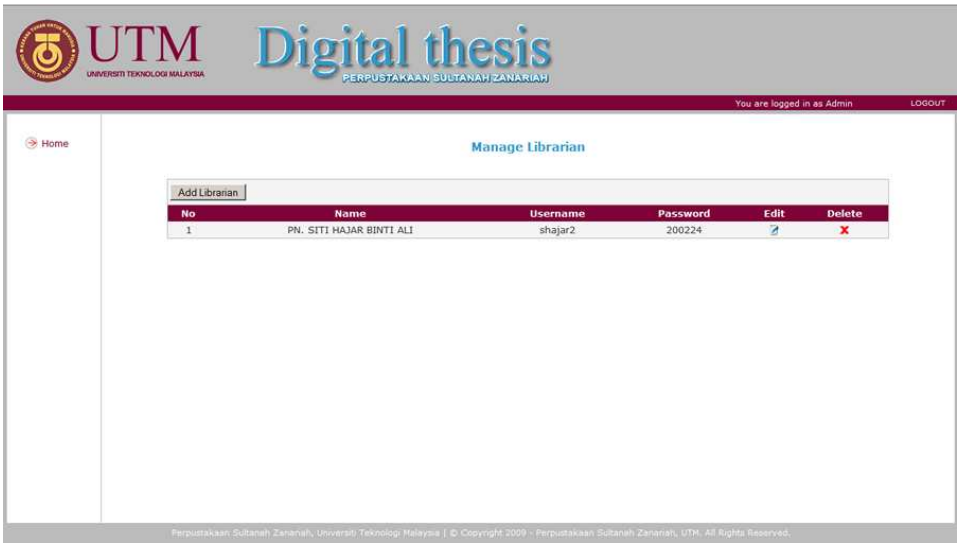


Figure 4.21 Manage Librarian from Admin Module

b) Librarian module

This module is also restricted to librarians. This module serves in order to librarians be able to upload the new digitized theses with metadata into database. Here librarians can edit the metadata associated with thesis or delete the whole document from database. Also librarians can view the list of all digitized theses uploaded into database.

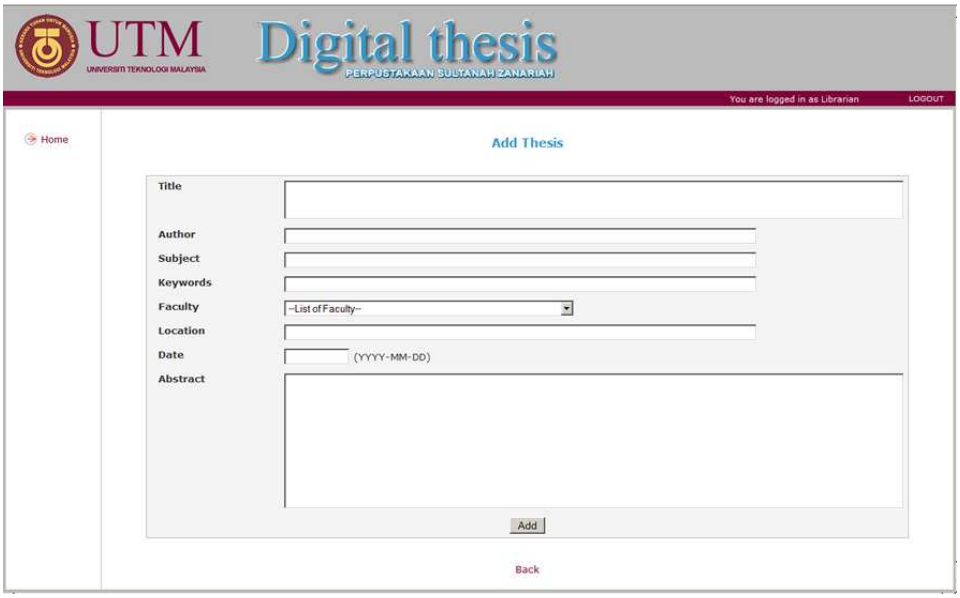


Figure 4.22 Add Thesis menu from Librarian Module

4.6 Hardware Requirements

Hardware justification is a basic necessity which needed in developing a system. The hardware is included input and output devices, storage devices and data processor. The identified hardware which is needed in this system development is as in Table 4.9 below:

Table 4.9 Hardware Requirements for proposed system

Features	**Technical Specifications**
Processor	Type: Intel 4 Clock Speed: 3.02 GHz
Motherboard	Chipset Type: Intel 915G Express Data Bus Speed: 800 MHz
Random Access Memory (RAM)	Speed: 4 GB Technology: DDR SDRAM
Storage Hard Disk	Interface: Serial ATA-150

	Type: Standard Size: 2 TB
Optical Storage	Type: CD/DVD Read Read Speed: 48x
Cache Memory	Type: L2 Cache Speed: 2 MB
Interface	2 Ethernet USB 2.0 1 Keyboard RJ-45 1 Mouse 1 USB 2.0 8 Display/Video
Monitor	17” Digital Monitor

4.7 Chapter summary

In this chapter the background of organization Sultanah Zanariah Libarary as the project case study has been discussed. The existing processes or “as-is processes” that involved in preserving microfilm archives has been identified and modeled using Unified Modeling Language (UML). Based on this processes, the analysis of project has done to identify the user requirements.

Derived from user requirements, ‘to-be processes’ for project has been done and the final designing process has been done carefully. All the process has been modeled using UML technique. Also database design, interface chart, and the logical design of main modules should be defined before the implementation stage.

CHAPTER V

DESIGN IMPLEMENTATION AND TESTING

5.1 Coding Approach

PHP is a server side scripting language, which can be embedded in HTML or used as a stand alone binary. Proprietary products in this niche are Microsoft's Active Server Pages, Macromedia's Cold Fusion, and Sun's Java Server Pages. Some tech journalists used to call PHP "the open source ASP" because its functionality is similar to that of the Microsoft product—although this formulation was misleading, as PHP was developed before ASP. Over he past few years, however, PHP and server side Java has gained momentum, while ASP has lost mindshare, so this comparison no longer seems appropriate.

The researcher will use PHP as the scripting language for this project because it is easy to use for Web development as it has been designed from the outset for the Web environment. That means that PHP has many built-in functions that make Web programming simpler, so that the researcher can focus on the logic of programming without wasting precious development time. Below is the list of unique benefits of PHP:

a) Rapid, iterative development cycles with a low learning curve. PHP is the easiest to learn and use compared with other Web development languages. The language syntax is very readable and understandable, simplifying team development and maintenance. The code, embedded within HTML pages, can be quickly deployed and tested, supporting an iterative development process incorporating frequent user feedback. All of this leads to improved developer productivity and better resulting applications.

b) Robust, high-performance and scalable platform; stable and secure.

PHP is designed for building Web applications that are scalable up to a very large number of users. PHP is stable and secure, robust enough for business-critical applications requiring constant uptime and airtight security.

c) Easily integrated into heterogeneous enterprise environments and systems. PHP is fully interoperable with other languages, protocols, systems and databases, including C/C++, Java, Perl, COM/.NET, XML/Web services, LDAP, ODBC, Oracle and MySQL. As an open source product, PHP is deployable anywhere: on any platform, with any Web server, with any database. PHP is not tied to any proprietary platforms or technologies.

d) Proven through widespread deployment and supported by a vibrant community. PHP is the most widely deployed and used Web development language on the Internet, surpassing ASP, JSP and Perl. The language has a vibrant community of users continuing to support and improve the language. The easy extensibility of PHP makes it very flexible in supporting new capabilities and enabling to take advantage of extensions done by others.

For the purpose of designing the system interface, XAMPP will be used. XAMPP is a complete software package which allows the use of all the strength and flexibility offered by the dynamic language PHP and the efficient use of databases under Windows. XAMPP Package includes an Apache server, a MySQL database, a full PHP execution as well as development tools for the portal.

MySQL is an open source, SQL Relational Database Management System (RDBMS) that is free for many uses. The history can be traced as far back as 1979, when my SQL's creator, Monty Wideness, worked for a Swedish IT and data consulting firm, TcX.

MySQL is chosen for this project since it is a very fast, multi-threaded, multi-user, and robust Structured Query Language database server. It is a relational database management system which stores data in separate tables rather than putting all the data in one big storeroom which adds speed and flexibility. The tables are linked by defined relations making it possible to combine data from several tables on request.

5.1.1 Snapshot of Critical Programming Codes

As mentioned above the Web-based Document Management and Filing Archival System is developed using PHP and JavaScript. Therefore, all pages in this system should be defined with .php. Please refer to **Appendix E** to view snapshot of critical programming codes.

5.2 Test Result/ System Evaluation

5.2.1 Unit Testing

The modules test is conducted according to the user groups which are clients and staff of PSZ Library. The following tables illustrate the system evaluation tests for the Web-based Document Management and Filing Archival System.

Table 5.1 System evaluation test for Clients of the proposed system

Test Case	Testing	Expected Result	Result
Authentication	Authentication of student	After username and password is inserted and submitted, student will be redirected to Student page	Valid
Search Thesis	The ability of user to search thesis by keyword	Search parameters are inserted into the search field and list of search results are provided	Valid
Browse Thesis	The ability of user to browse collection of digitized theses	After appropriate parameter to browse collection is selected (browse by faculty, author, title, or date) the list of theses is provided in sorted format	Valid
View Thesis detail	The possibility to view the metadata of selected thesis	After user select thesis title the appropriate page with thesis detail is appeared	Valid
View whole Thesis	The possibility of user to view the whole document	After user presses the thesis link the pdf document is opened in additional window	Valid

Table 5.2 System evaluation test for Staff of the proposed system

Test Case	Testing	Expected Result	Result
Authentication	Authentication of admin or librarian	After username and password is inserted and submitted, admin or librarian will be redirected to admin or librarian page	Valid
Manage Thesis	Add new Thesis	After appropriate fields (title, author, abstract, etc) are filled up the metadata is added into database	Valid
	Upload Thesis	After new thesis is selected it will be uploaded into *retrieve* folder	Valid
	Edit Thesis information	Librarian can update database by editing thesis information	Valid
	Delete Thesis information	Ability to delete thesis information from database table	Valid
Manage Faculty	Add new Faculty	After appropriate field (faculty) is filled up the faculty name added into database field	Valid
	Edit Faculty	Librarian can update database by editing faculty information	Valid
	Delete	Ability to delete faculty name from database field	Valid
Manage Librarian	Add new Librarian	Administrator can add new librarian by inserting librarian info into database	Valid
	Edit Librarian info	Administrator can update database by editing information about librarian	Valid
	Delete Librarian	Administrator's possibility to delete librarian info from database field	Valid

Manage Student	Add new Student	Administrator can add new student by inserting student info into database	Valid
	Edit Student info	Administrator can update database by editing information about student	Valid
	Delete Student	Administrator's possibility to delete student info from database field	Valid

5.2.2 User Acceptance Test

The primary purpose of user acceptance test is to obtain feedback from the end users of proposed system. It is executed by giving a questionnaire and user test. Please refer to **Appendix F** for user acceptance test questionnaires and result. Also you can refer to **Appendix G** to view 5 samples of user's feedback

5.3 User Manual

Before operating the system users should read user manual. User manual includes a step-by-step instructions how to use the system. User manual is attached at **Appendix H**.

5.4 Chapter summary

The system was developed using PHP and JavaScript and took place during implementation phase. The system implementation was done according to as discussed in chapter iv.

Unit and system testing is conducted to make sure that the system run effectively and without errors. After that the user acceptance test is conducted to obtain feedback from the end users of proposed system. On basis of information and comments gathered from the end users improvements have been made to the system.

CHAPTER VI

ORGANIZATIONAL STRATEGY

6.1. Rollout Strategy

As the basic medium of long-term preservation of important information the library uses microfilms. The huge archive of microfilms is stored in library, at the same time access to the information stored in this archive is very complicated. There is not enough microfilm reader in library by means of which it is possible to view microfilms. Currently PSZ using 2 microfilm reader machine to provide access to those microfilms.

For a successful transition from the old system to the new system, some phase type rollout strategies are proposed.

Firstly it is required to procure the necessary equipment. In our case it’s Microfilm Scanners. The library must decide how many scanners they need to digitize a collection of retrospective theses. Then it is necessary that the library will appoint a webmaster who will also act as an Administrator for proposed system.

Thus the library itself will be able to install the necessary software for the successful management of the system. Administrator might be a programmer from the library staff.

In the future, in order to system can work effectively with PSZ Library Catalogue system administrator should add MARC fields for each digitized thesis. Next, you can export the 856 MARC field containing URL back into MARC record in the Library Catalogue. This would allow library's users to search theses directly from OPAC.

In connection with the widespread usage of mobile devices Web-based Document Management and Filing Archival System can be extended to offer access possibilities to theses through mobile technology. Mobile-based system will open up for users' possibilities to access library resources anywhere and at any time. But for this purpose PSZ need to decide which possibilities to provide and what interface will be presented in the mobile version.

6.2. Change Management

To ensure a successful execution of the proposed Document Management and Filing Archival System, the following change management strategies are suggested to Perpustakaan Sultanah Zanariah (PSZ):

- Staff training

  To ensure the Document Management and Filing Archival System will be fully utilized by staff of PSZ, appropriate training program should be provided. The training may consist of working procedures and troubleshooting should be able to facilitate the staff in using the system without any problems.

- Student training

  To digitize the entire collection of retrospective theses UTM Library should hire students to help in this process. First of all we should train them how to work with Microfilm scanner and microfilm software in effective way.

- Administration training

  The system will continuously develop. We plan to add MARC records for each digitized thesis, so the students can search them using PSZ OPAC system. Therefore, sufficient training should be provided to the appointed Administrator especially in web development fields and librarian catalogue rules for future development of the proposed system.

- System registration

  The proposed system need to be widely exposed to the students of UTM to ensure that people know the existence of that particular system. In consequence to that, the Document Management and Filing Archival System should have its unique domain name searchable by the public using various search engines available in the Internet.

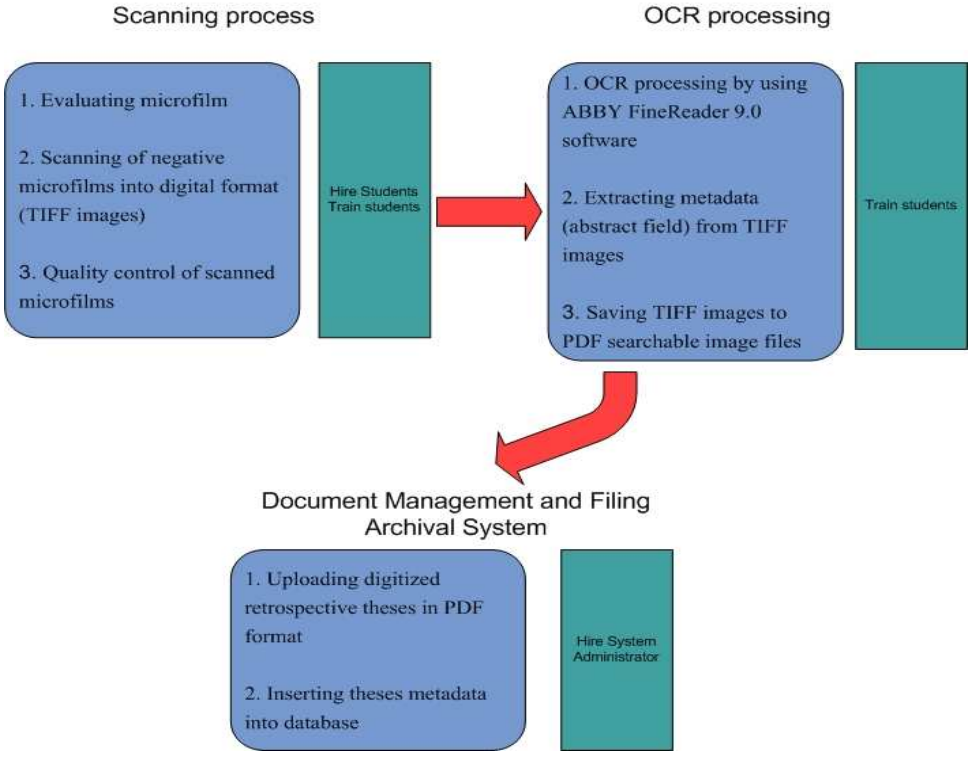

Scanning process
1. Evaluating microfilm
2. Scanning of negative microfilms into digital format (TIFF images)
3. Quality control of scanned microfilms
Hire Students
Train students
OCR processing
1. OCR processing by using ABBY FineReader 9.0 software
2. Extracting metadata (abstract field) from TIFF images
3. Saving TIFF images to PDF searchable image files
Train students
Document Management and Filing Archival System
1. Uploading digitized retrospective theses in PDF format
2. Inserting theses metadata into database
Hire System Administrator

Figure 6.1 Implementation guideline for proposed system

Figure 6.1 above shows implementation guideline for proposed system.

Effective combination of people and leadership will help with strategic direction and successful plan delivery. Therefore, it is important to obtain full support and commitment from the top management in executing the strategies mentioned above. This is to ensure that the Document Management and Filing Archival System can be implemented more effectively and efficiently.

6.3. Data Migration Plan

Data migration is the process of migrating data from one location to another. Appropriate data migration plan is needed to ensure smooth migration from old system to computerized system or improved or reengineered BP.

As the main data for the proposed system we will use microfilms themselves, theses names, metadata for these theses such as title, author, issue date, publication place etc.

The process of migration data from old system to new system consist of several stages:

- Scanning microfilms using FlexScan scanner;
- Extracting metadata from scanned microfilm using ABBY FineReader 9.0 OCR software;
- Inserting digitized theses in PDF format with metadata into database tables of new system.

6.4. Business Continuity Plan (BCP)

Since the proposed system preserves data in digital format the PSZ Library should permanently worry about data integrity or data loss in case of any disaster or disruption strikes. Also active management of Digital files is necessary to handle the impermanence of optical and magnetic media and the rapid change in hardware and software configurations. PSZ Library should undertake following activities:

- Refreshing (moving files to new storage media periodically without altering their format or content)
- Periodic checks for the integrity of the digital object (authenticity and completeness) using, for example, a checksum value
- Redundancy (keeping many copies of digital files and comparing them against each other to ensure no data are lost or corrupted)
- Migration (periodic transformation of files to new digital formats to ensure continuing compatibility between file formats and applications)
- Emulation (enabling obsolete systems to be run on future unknown systems, making it possible to retrieve, display and use digital documents with their original software)

6.5. Expected Competitive Advantage Gain from the Proposed System

Having digitized a collection of retrospective theses and having made its accessible through the Internet, there is an open up possibilities to students of UTM to look through these works in online mode. And if earlier it could be made only to the limited number of students in special rooms now with an opportunity of access through the Internet it can do unlimited number of students. Thus proposed system solves the main problem of old system based on technology of microfilms connected with access.

Implementing of the system for PSZ can be expected to get the following organizational benefits:

- Improve access to digitized theses;
- More students can read these theses simultaneously;
- Library can safe money on storing theses on digital medium because the prices for it continue to decrease considerably in contrast to the prices for storage on microfilm medium;
- After successful implementation of this project there is no need to microfilm theses anymore, UTM Library will store them only in digital and hardcopy format.

6.6. Chapter summary

This chapter explains in detail the steps that need to be done by Library staff to the successful implementation of Document Management and Filing Archival System. Actions that need to be performed after the implementation of the project are very important as the actual implementation, because they will help to effectively use of the system. This chapter indicates that the system can be expanded in the future by creating a mobile-based version of the system. An administrator of the system performs a significant role, because he can realize those ideas in the future. There have also been touched problems associated with the possibility of loss and integrity of data, as well as ways to solve them.

CHAPTER VII

CONCLUSIONS

7.1 Introduction

This project is about implementation of web-based Document Management and Filing Archival System. The goal of this project is to propose system that will help to computerize the process of storing, retrieving and searching microfilms in Sultanah Zanariah Library after digitizing the microfilm collection using special microfilm scanner.

The proposed system is intended to help both librarians and users of Sultanah Zanariah Library to easy access, control, manage digitized microfilms using computers through local area connection or Internet. It is hoped that implementation of this system will increase the number of users who can easy access these documents i.e. retrospective theses.

7.2 Achievements

After conducting the initial findings the current process of preserving microfilm archive in Sultanah Zanariah Library have been clear understood. Important data have been collected from observations and interviews with Head of Automation Department and librarians who are responsible for microfilming process. Also from conducting initial findings it was determined the current problems in storing historical data in microfilm format. It was found out that the library has a mind to convert its microfilm collection into digital format.

7.3 Constraints and Challenges

Throughout the system development, there have been few constraints that have affected the eventual functionality of the system. Some of the constraints are identified as following:

a) The lack of knowledge in catalogue rules and standards for electronic documents did not allow including MARC records for digital theses into the system.

b) The PSZ Library does not have any microfilm scanners currently. Without having a microfilm scanner it is impossible to scan sample microfilms and process them after that. As the result, I had to search for documents scanned from microfilm in the Internet.

c) Limited time to develop the system and write report. Having more time on study and system development it’s hoped that the system functionalities could be improved.

7.4 Aspirations

After completion of Project 2, it is hoped that

i. All the objectives of the system that has been pointed out in the beginning of the project have been achieved.

ii. The Document Management and Filing Archival System have been implemented successfully in the PSZ Library.

iii. Users of this system i.e. librarians and library's users can use the system without any difficulty.

iv. The number of scholars who want to view and work with retrospective theses collection considerable increased.

v. After successfully implementation the system can also be used in other university libraries.

7.5 Future work

In the future, in order to system can work effectively with PSZ Library Catalogue system MARC fields should be included for each digital thesis. It is possible to link proposed system directly to PSZ OPAC system by exporting 856 MARC field containing URL address of the thesis back into Library Catalogue system.

In connection with the widespread usage of mobile devices Web-based Document Management and Filing Archival System can be extended to offer access possibilities to theses through mobile technology. Mobile-based system will open up for users' possibilities to access library resources anywhere and at any time. But for

this purpose PSZ need to decide which possibilities to provide and what interface will be presented in the mobile version.

7.6 Summary

In conclusion, the main objective of this project – the development of a web-based Document Management and Filing Archival System – is achieved, all activities are completed.

Hopefully the Document Management and Filing Archival System after successful implementation can solve the main problem of old system based on microfilm technology connected with the lack of scholarly access for retrospective theses collection.

REFERENCES

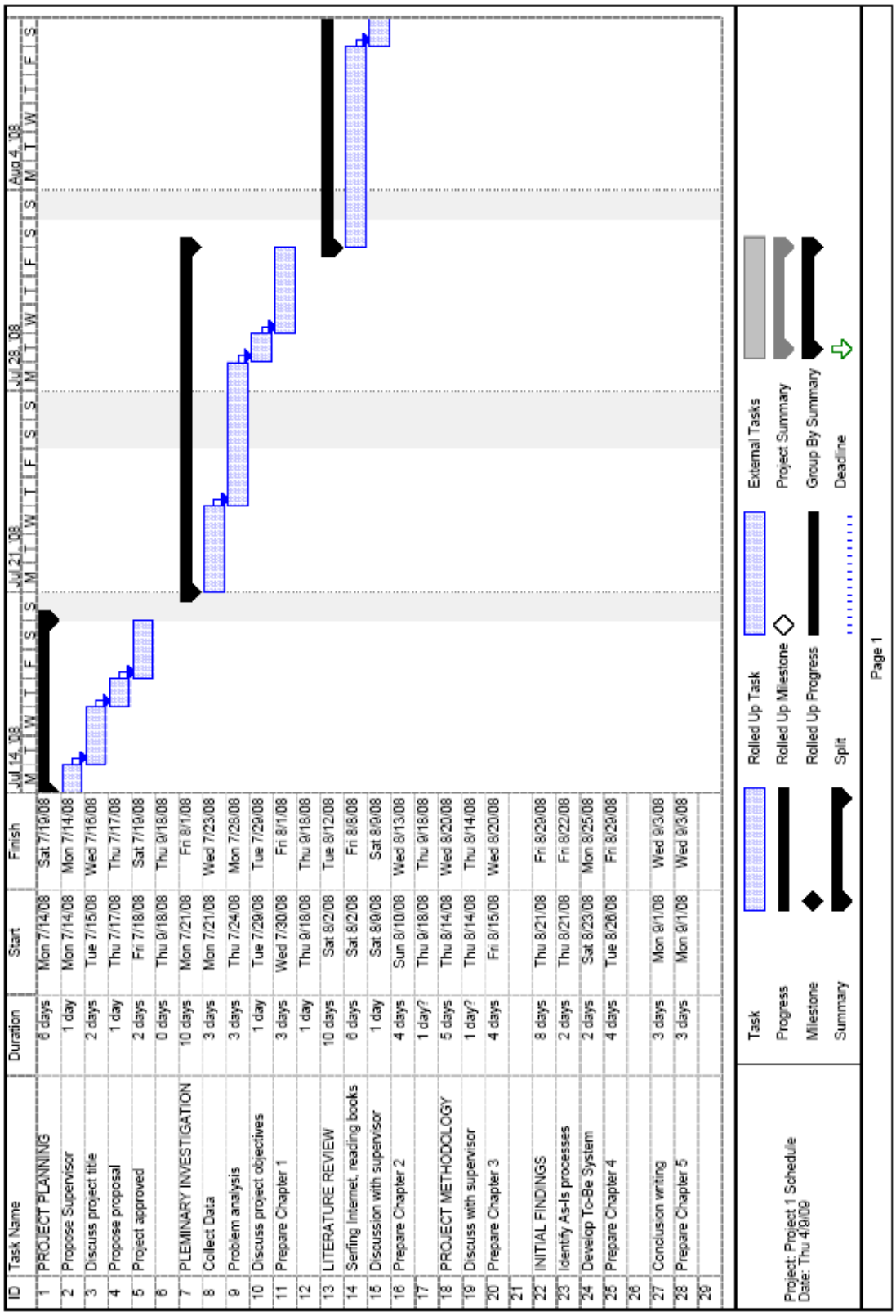
1. http://en.wikipedia.org/wiki/Document_Management - Document management system - From Wikipedia, the free encyclopedia.
2. Waters, D.J. What are Digital Libraries? 1998. CLIR (Council on Library and Information Resources) Issues, No.4. http://www.clir.org/pubs/issues04.html.
3. Nathan Krevolin, 1986, *Records/Information Management and Filing*, Prentice-Hall, Englewood Cliffs, New Jersey, 260 p.
4. http://en.wikipedia.org/wiki/Microfilm - From Wikipedia, the free encyclopedia.
5. Thomas M. Koulopoulos, Carl Frappaolo, 1995, *Electronic Document Management Systems*, McGraw-Hill, New York, 313 p.
6. Kathleen Arthur, Sherry Byrne, Elisabeth Long, Carla Q. Montori, Judith Nadler, 2004, *Recognizing Digitization as a Preservation Reformatting Method.* (White paper)
7. Todd M. Mundle. Digital Retrospective Conversion of Theses and Dissertations: an In House Project. *ETD2005 Conference.* 2005. Simon Fraser University Library, Burnaby, BC Canada: 1-4.
8. Scott Van Jacob. *CRL/LAMP Brazilian Government Serials Digitization Project.* December 2001. Center for Research Libraries, 95 p.
9. Judith A.K. Terpstra, Frederick Zarndt, David Ongley, Stefan Boddie (2005). The Tundra Times Newspaper Digitization Project. *RLG DigiNews*, 9. Tuzzy Consortium Library
10. Canon. *MS-800 Digital Microfilm Scanner.* MTM International: Trade brochure. 2007.

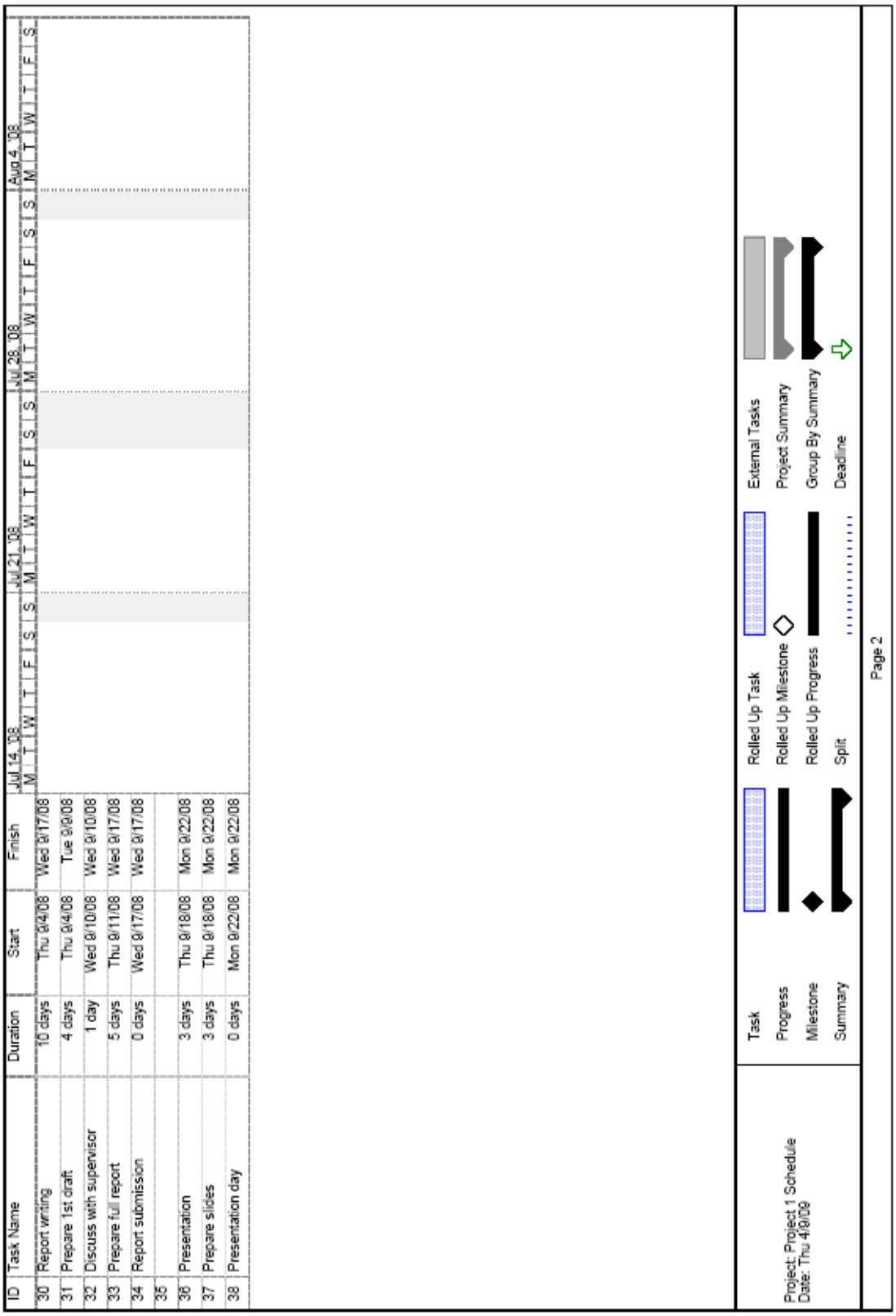
11. Data Financial Business Services, Inc. *ScanPro 1000 All-In-One Microfilm Viewer, Scanner-to-PC, Printer.* Image Data: Trade brochure.
12. SunRise Imaging, Inc. *3 in 1 SpeedScan Hardware Specifications*. Santa Ana (USA): Trade brochure.
13. NexrScan. *FlexScan 2 in 1 Scanner for Rollfilm and Microfiche.* Eagle: Trade brochure.
14. http://www.futureofthebook.com/stories/storyReader$640
15. http://www.clir.org/PUBS/reports/willis/ - A Hybrid Systems Approach to Preservation of Printed Materials
16. Steve Gilheany, 2003, *The Document Management Continuum*, ArchiveBuilders.com, 562. (white paper)
17. Kathleen Arthur, Sherry Byrne, Elisabeth Long, Carla Q. Montori, Judith Nadler, 2004, *Recognizing Digitization as a Preservation Reformatting Method.* (White paper)
18. Chapman S., *Counting the costs of digital preservation: is repository storage affordable?*, <<Journal of Digital Information>>, May 2003, http://jodi.ecs.soton.ac.uk
19. Waters, D.J. What are Digital Libraries? 1998. CLIR (Council on Library and Information Resources) Issues, No.4. http://www.clir.org/pubs/issues04.html
20. William Y.Arms, 2000, *Digital Libraries*, The MIT Press Cambridge, Massachusetts, 287 p.
21. U.M.Borgoff, P.Rodig, J.Scheffczyk, L.Schmitz, 2003, *Long-Term Preservation of Digital Documents*, Springer, Berlin, 274 p.
22. John Feather, 2004, *Managing Preservation for Libraries and Archives*, Ashgate, Burlington, 181 p.

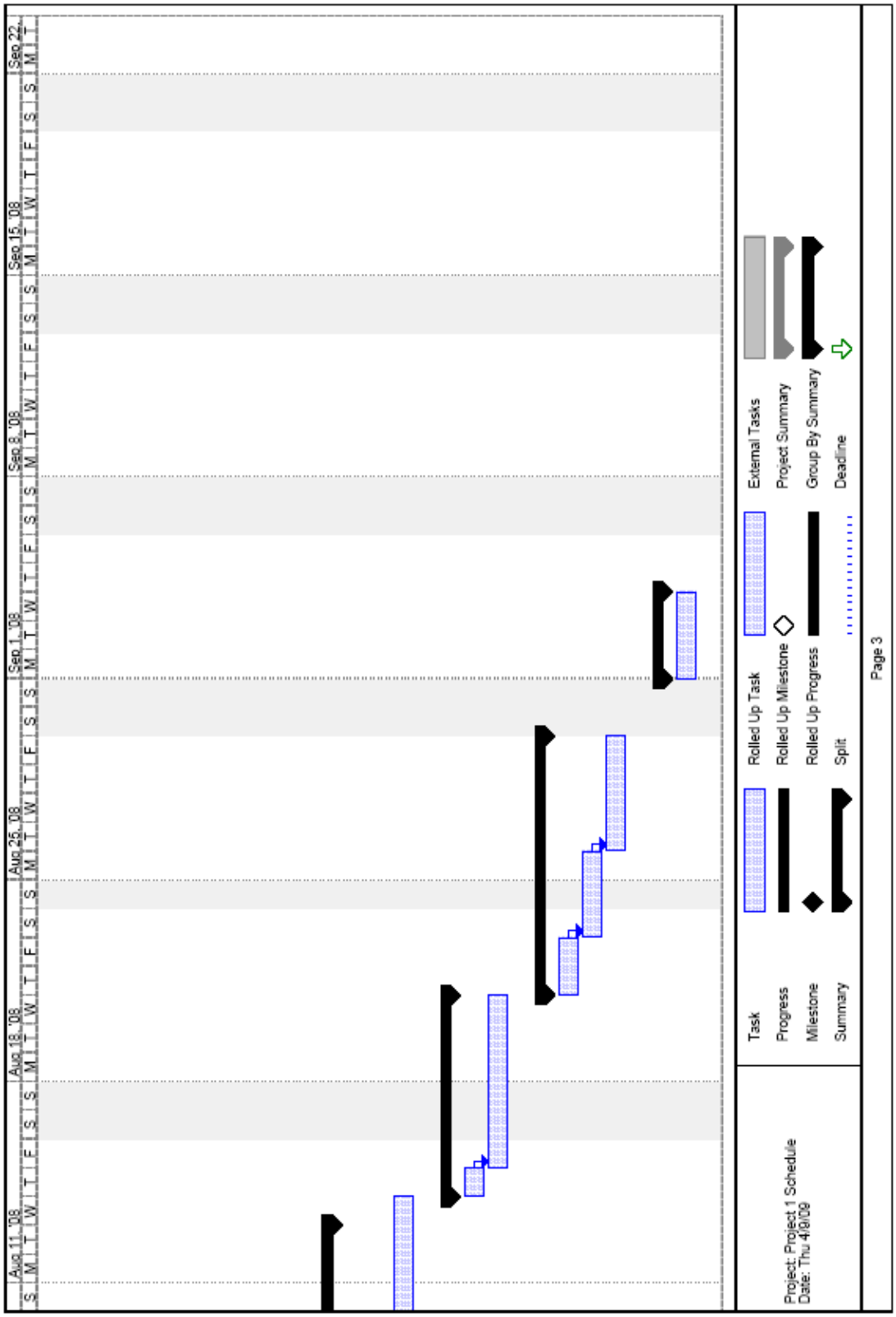
APPENDIX A

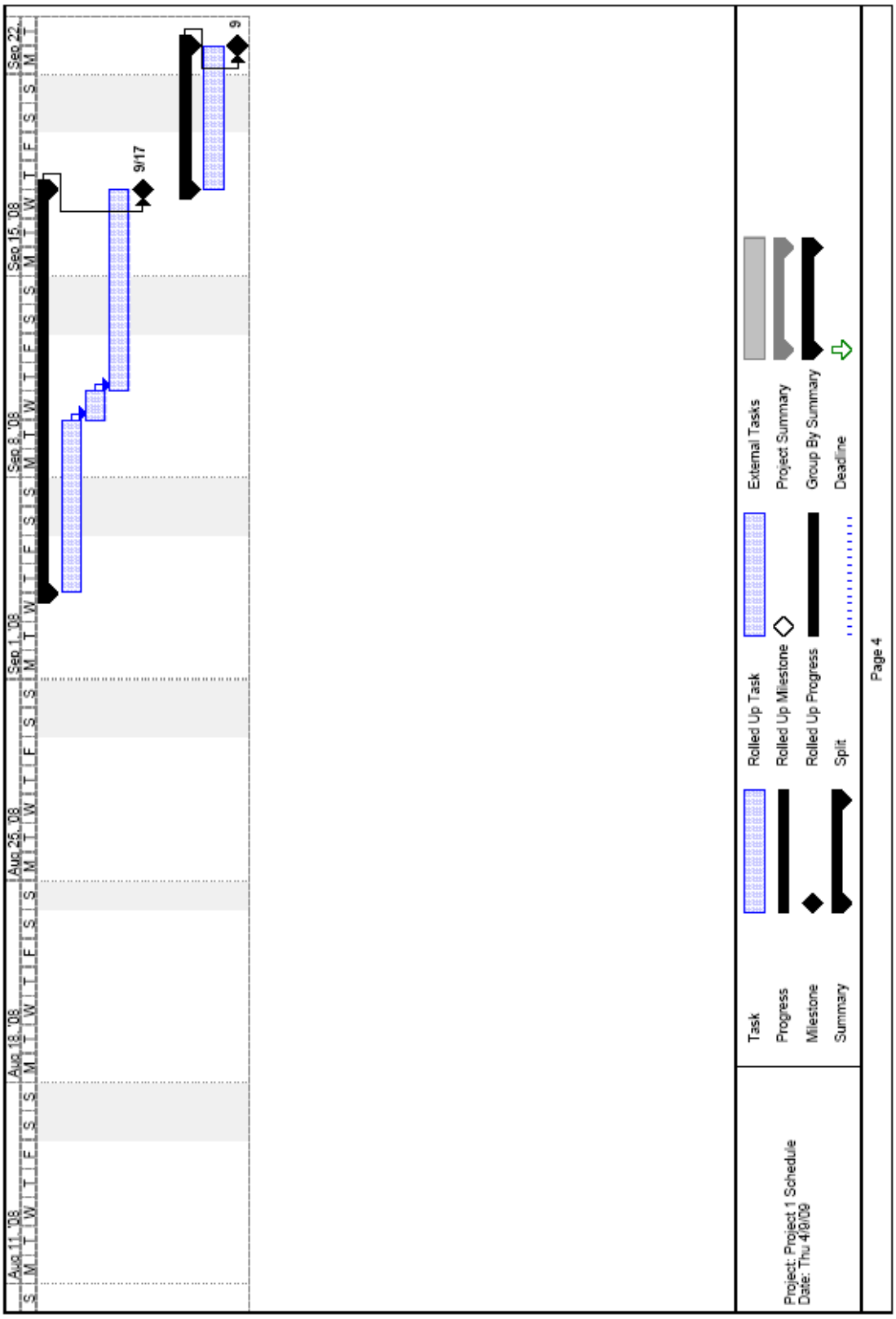
GANTT CHART

Gantt Chart for Project 1:

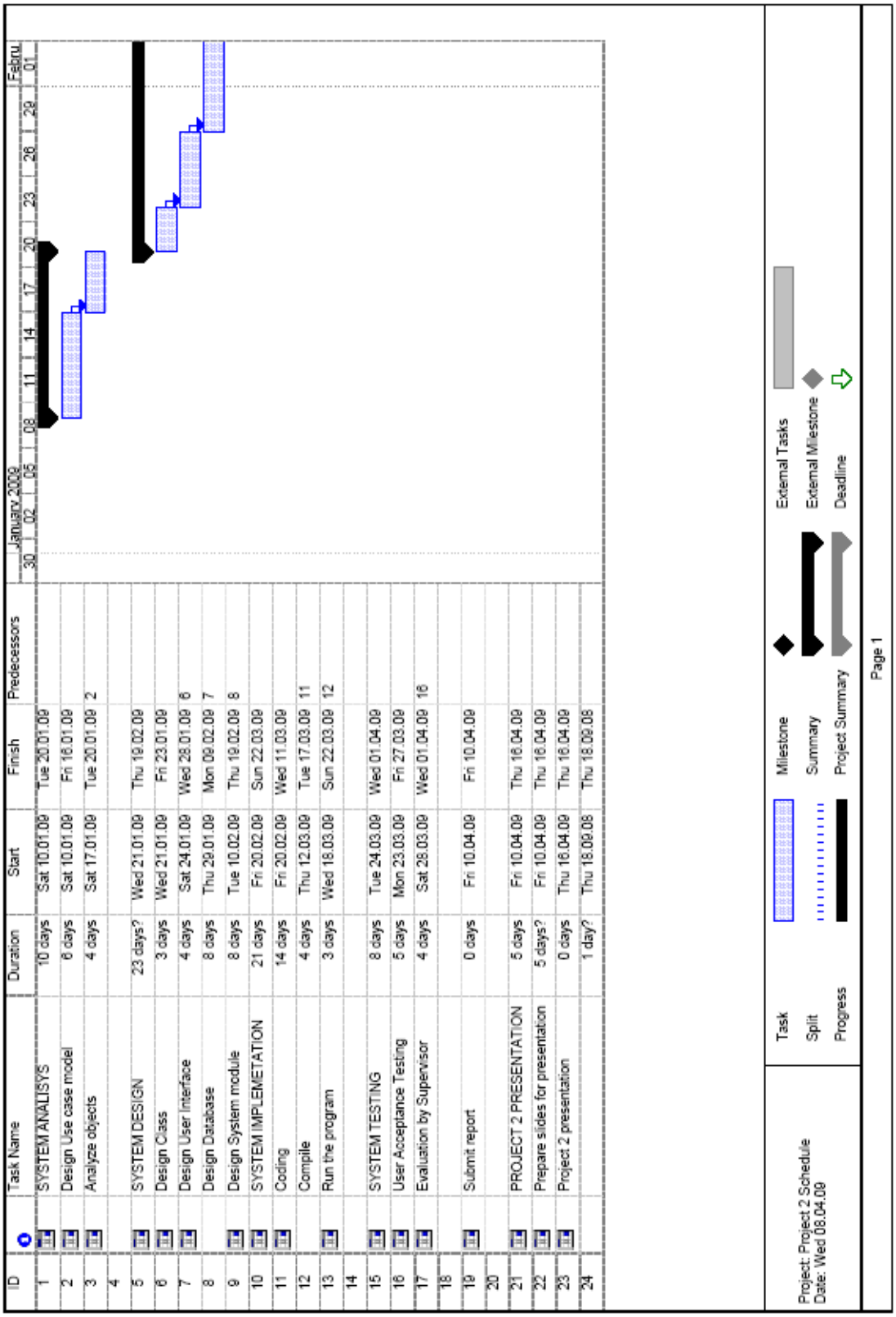

ID
Task Name
Duration
Start
Finish
1 PROJECT PLANNING 8 days Mon 7/14/08 Sat 7/19/08
2 Propose Supervisor 1 day Mon 7/14/08 Mon 7/14/08
3 Discuss project title 2 days Tue 7/15/08 Wed 7/16/08
4 Propose proposal 1 day Thu 7/17/08 Thu 7/17/08
5 Project approved 2 days Fri 7/18/08 Sat 7/19/08
6 0 days Thu 8/18/08 Thu 8/18/08
7 PLEMINARY INVESTIGATION 10 days Mon 7/21/08 Fri 8/1/08
8 Collect Data 3 days Mon 7/21/08 Wed 7/23/08
9 Problem analysis 3 days Thu 7/24/08 Mon 7/28/08
10 Discuss project objectives 1 day Tue 7/29/08 Tue 7/29/08
11 Prepare Chapter 1 3 days Wed 7/30/08 Fri 8/1/08
12 1 day Thu 8/18/08 Thu 8/18/08
13 LITERATURE REVIEW 10 days Sat 8/2/08 Tue 8/12/08
14 Serfing Internet, reading books 6 days Sat 8/2/08 Fri 8/8/08
15 Discussion with supervisor 1 day Sat 8/8/08 Sat 8/9/08
16 Prepare Chapter 2 4 days Sun 8/10/08 Wed 8/13/08
17 1 day? Thu 8/18/08 Thu 8/18/08
18 PROJECT METHODOLOGY 5 days Thu 8/14/08 Wed 8/20/08
19 Discuss with supervisor 1 day? Thu 8/14/08 Thu 8/14/08
20 Prepare Chapter 3 4 days Fri 8/15/08 Wed 8/20/08
21
22 INITIAL FINDINGS 8 days Thu 8/21/08 Fri 8/29/08
23 Identify As-Is processes 2 days Thu 8/21/08 Fri 8/22/08
24 Develop To-Be System 2 days Sat 8/23/08 Mon 8/25/08
25 Prepare Chapter 4 4 days Tue 8/26/08 Fri 8/29/08
26
27 Conclusion writing 3 days Mon 9/1/08 Wed 9/3/08
28 Prepare Chapter 5 3 days Mon 9/1/08 Wed 9/3/08
29
Jul 14 '08
Jul 21 '08
Jul 28 '08
Aug 4 '08
Project: Project 1 Schedule
Date: Thu 4/9/09
Task
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Milestone
Rolled Up Progress
Split
External Tasks
Project Summary
Group By Summary
Deadline
Page 1

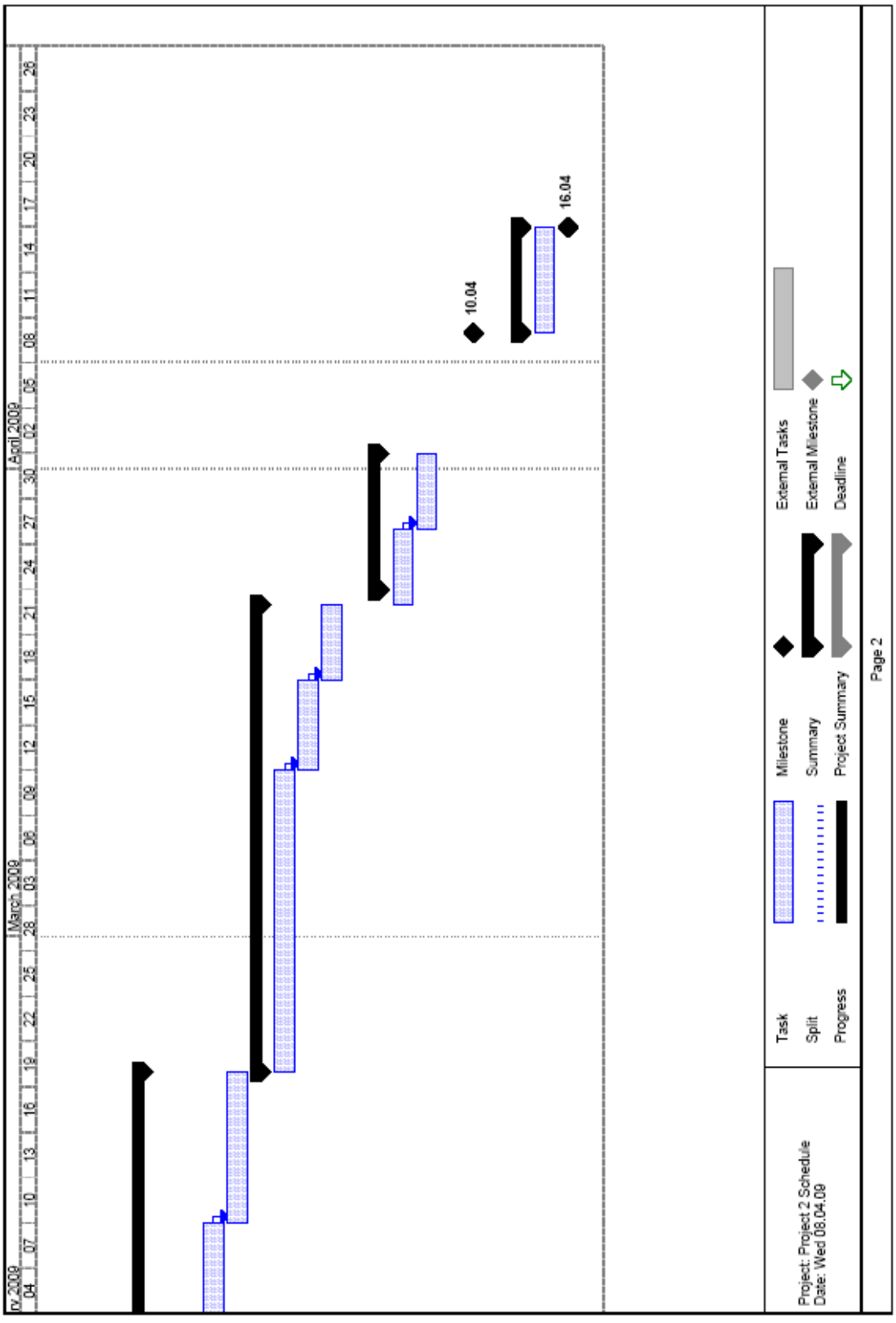

ID
Task Name
Duration
Start
Finish
Jul 14 '08
Jul 21 '08
Jul 28 '08
Aug 4 '08
30 Report writing 10 days Thu 8/4/08 Wed 8/17/08
31 Prepare 1st draft 4 days Thu 8/4/08 Tue 8/9/08
32 Discuss with supervisor 1 day Wed 8/10/08 Wed 8/10/08
33 Prepare full report 5 days Thu 8/11/08 Wed 8/17/08
34 Report submission 0 days Wed 8/17/08 Wed 8/17/08
35
36 Presentation 3 days Thu 8/18/08 Mon 8/22/08
37 Prepare slides 3 days Thu 8/18/08 Mon 8/22/08
38 Presentation day 0 days Mon 8/22/08 Mon 8/22/08
Project: Project 1 Schedule
Date: Thu 4/8/09
Task
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Milestone
Rolled Up Progress
Split
External Tasks
Project Summary
Group By Summary
Deadline
Page 2


Aug 11, '08
Aug 18, '08
Aug 25, '08
Sep 1, '08
Sep 8, '08
Sep 15, '08
Sep 22, '08
Task
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Milestone
Rolled Up Progress
Split
External Tasks
Project Summary
Group By Summary
Deadline
Project: Project 1 Schedule
Date: Thu 4/9/09
Page 3


Aug 11 '08
Aug 18 '08
Aug 25 '08
Sep 1 '08
Sep 8 '08
Sep 15 '08
Sep 22
9/17
9
Project: Project 1 Schedule
Date: Thu 4/9/09
Task
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Milestone
Rolled Up Progress
Split
External Tasks
Project Summary
Group By Summary
Deadline
Page 4

Gantt Chart for Project 2:


ID
Task Name
Duration
Start
Finish
Predecessors
1 SYSTEM ANALISYS 10 days Sat 10.01.09 Tue 20.01.09
2 Design Use case model 6 days Sat 10.01.09 Fri 16.01.09
3 Analyze objects 4 days Sat 17.01.09 Tue 20.01.09 2
5 SYSTEM DESIGN 23 days? Wed 21.01.09 Thu 19.02.09
6 Design Class 3 days Wed 21.01.09 Fri 23.01.09
7 Design User interface 4 days Sat 24.01.09 Wed 28.01.09 6
8 Design Database 8 days Thu 29.01.09 Mon 09.02.09 7
9 Design System module 8 days Tue 10.02.09 Thu 19.02.09 8
10 SYSTEM IMPLEMETATION 21 days Fri 20.02.09 Sun 22.03.09
11 Coding 14 days Fri 20.02.09 Wed 11.03.09
12 Compile 4 days Thu 12.03.09 Tue 17.03.09 11
13 Run the program 3 days Wed 18.03.09 Sun 22.03.09 12
15 SYSTEM TESTING 8 days Tue 24.03.09 Wed 01.04.09
16 User Acceptance Testing 5 days Mon 23.03.09 Fri 27.03.09
17 Evaluation by Supervisor 4 days Sat 28.03.09 Wed 01.04.09 16
19 Submit report 0 days Fri 10.04.09 Fri 10.04.09
21 PROJECT 2 PRESENTATION 5 days Fri 10.04.09 Thu 16.04.09
22 Prepare slides for presentation 5 days? Fri 10.04.09 Thu 16.04.09
23 Project 2 presentation 0 days Thu 16.04.09 Thu 16.04.09
24 1 day? Thu 18.06.08 Thu 18.06.08
January 2009
30 02 05 08 11 14 17 20 23 26 29
Febru
01
Project: Project 2 Schedule
Date: Wed 06.04.09
Task
Split
Progress
Milestone
Summary
Project Summary
External Tasks
External Milestone
Deadline
Page 1


Nov 2009
04
07
10
13
16
19
22
25
March 2009
28
03
06
09
12
15
18
21
24
27
30
April 2009
02
05
08
11
14
17
20
23
26
10.04
16.04
Project: Project 2 Schedule
Date: Wed 08.04.09
Task
Split
Progress
Milestone
Summary
Project Summary
External Tasks
External Milestone
Deadline
Page 2

APPENDIX B

Interview Questions

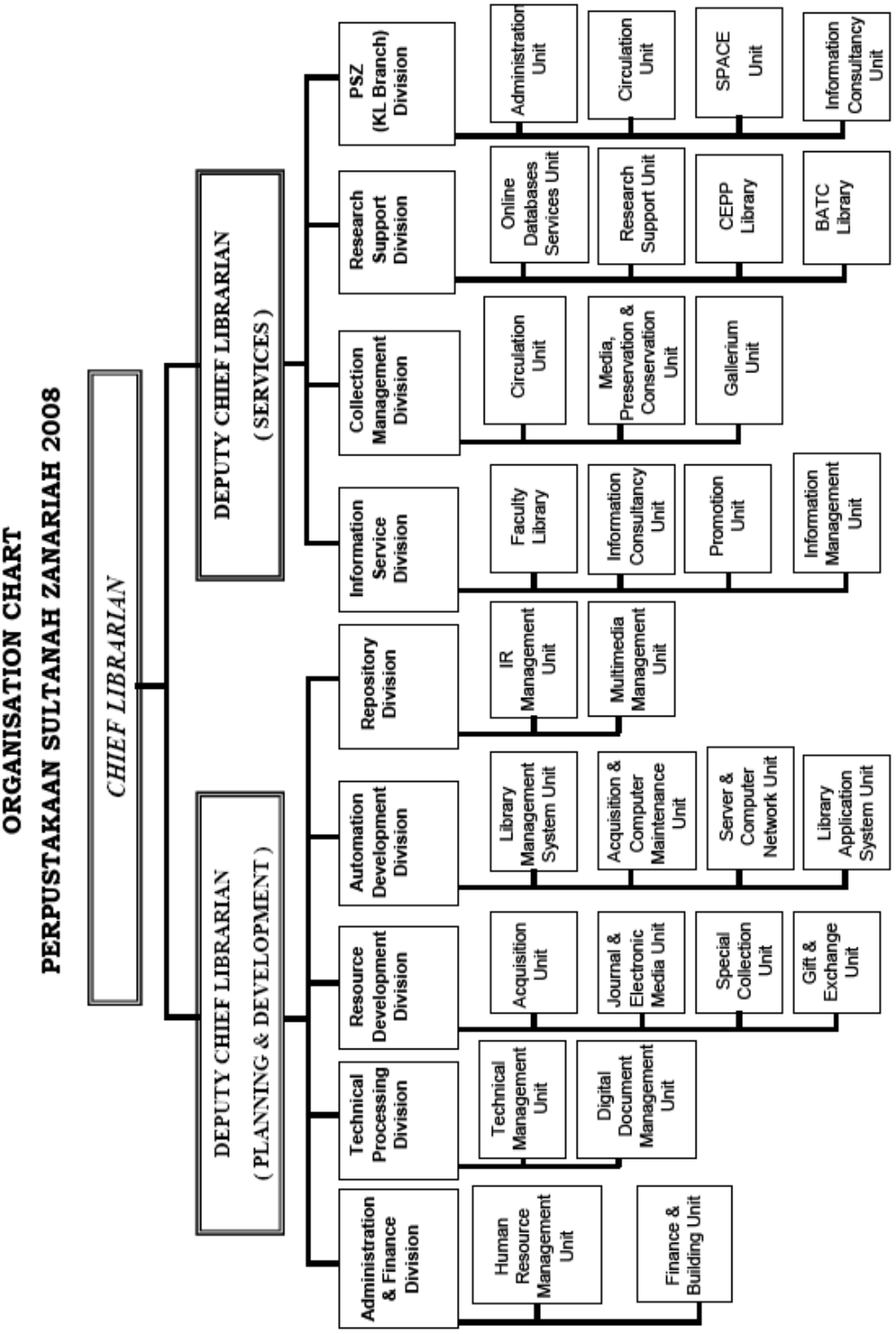
1. What approximately the quantity of microfilms is stored in Sultanah Zanariah Library?
2. How the process of microfilming in Sultanah Zanariah Library is organized?
3. How are you processing and indexing microfilm?
4. Which storage medium are you using to preserve microfilm?
5. How this microfilm is used and retrieved?
6. How do you archive the microfilm?
7. Which type of documents you are preserving on microfilm?
8. Which problems are you facing with when storing microfilmers?
9. How many microfilm readers does PSZ Library have?

10. Will you process images by using any OCR software when scanning from hard copies?
11. Which scanning resolution do you use when scanning from hard copies?
12. Is PSZ Library going to buy any microfilm scannenrs?

APPENDIX C

Organizational Chart of PSZ Library

ORGANISATION CHART
PERPUSTAKAAN SULTANAH ZANARIAH 2008



APPENDIX D

Database Design

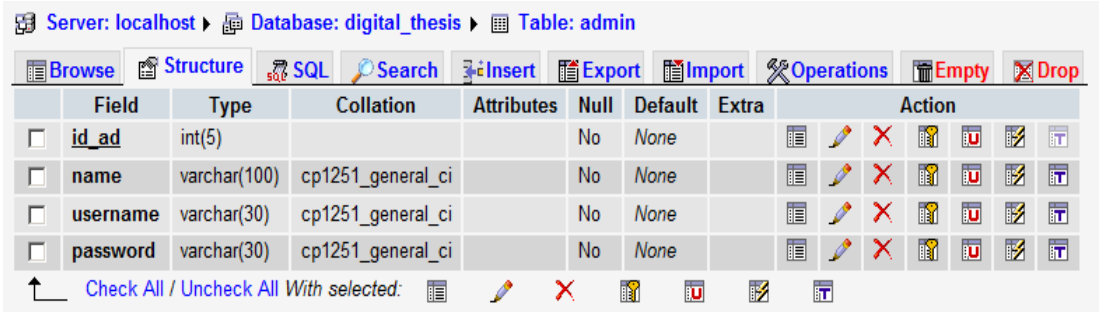


Table: Admin

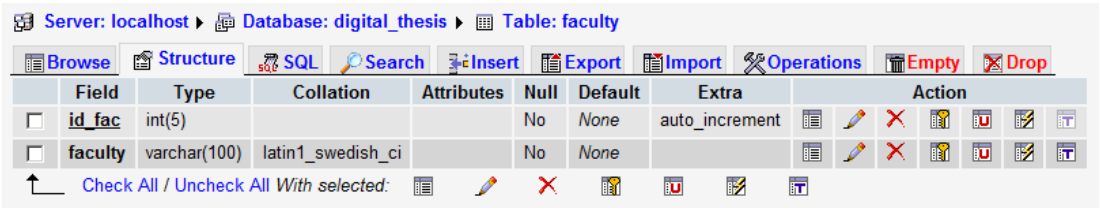


Table: Faculty

Server: localhost ▸ Database: digital_thesis ▸ Table: librarians

Browse | Structure | SQL | Search | Insert | Export | Import | Operations | Empty | Drop

	Field	Type	Collation	Attributes	Null	Default	Extra	Action
☐	id_lib	int(5)			No	None	auto_increment	
☐	name	varchar(100)	latin1_swedish_ci		No	None		
☐	username	varchar(30)	latin1_swedish_ci		No	None		
☐	password	varchar(30)	latin1_swedish_ci		No	None		

Check All / Uncheck All *With selected:*

Table: Librarians

Server: localhost ▸ Database: digital_thesis ▸ Table: students

Browse | Structure | SQL | Search | Insert | Export | Import | Operations | Empty | Drop

	Field	Type	Collation	Attributes	Null	Default	Extra	Action
☐	id_stud	int(5)			No	None	auto_increment	
☐	name	varchar(100)	latin1_swedish_ci		No	None		
☐	username	varchar(30)	latin1_swedish_ci		No	None		
☐	password	varchar(30)	latin1_swedish_ci		No	None		

Check All / Uncheck All *With selected:*

Table: Students

Server: localhost ▸ Database: digital_thesis ▸ Table: thesis

Browse | Structure | SQL | Search | Insert | Export | Import | Operations | Empty | Drop

	Field	Type	Collation	Attributes	Null	Default	Extra	Action
☐	thesis_id	int(4)			No	None	auto_increment	
☐	title	text	latin1_swedish_ci		No	None		
☐	author	text	latin1_swedish_ci		No	None		
☐	subject	text	latin1_swedish_ci		No	None		
☐	abstract	longtext	latin1_swedish_ci		No	None		
☐	keywords	varchar(100)	latin1_swedish_ci		No	None		
☐	place	text	latin1_swedish_ci		No	None		
☐	date	date			No	None		
☐	file	text	latin1_swedish_ci		No	None		
☐	size	varchar(20)	latin1_swedish_ci		No	None		
☐	depositedby	varchar(50)	latin1_swedish_ci		No	None		
☐	depositedon	date			No	None		
☐	id_fac	int(11)			No	None		

Check All / Uncheck All *With selected:*

Table: Thesis

APPENDIX E

Critical programming codes

1. PHP Coding of Authentication of users

```
<?php
include("blocks/db.php"); /* Coonecting to database*/
session_start();
if(isset($_POST['sbm']))
{
$result = mysql_query("SELECT * FROM librarians WHERE
username='".mysql_real_escape_string($_POST['username'])."' AND
password='".mysql_real_escape_string($_POST['password'])."'"); // librarian

$result1 = mysql_query("SELECT * FROM students WHERE
username='".mysql_real_escape_string($_POST['username'])."' AND
password='".mysql_real_escape_string($_POST['password'])."'"); //student

$result2 = mysql_query("SELECT * FROM admin WHERE
username='".mysql_real_escape_string($_POST['username'])."' AND
password='".mysql_real_escape_string($_POST['password'])."'"); //admin

if (mysql_num_rows($result) >0 )
{
    $myrow = mysql_fetch_array($result);
    $librarian_user = $myrow["name"];
    session_register("librarian_user") ;
    header("Location: librarian/index.php?librarian_user=$librarian_user"); exit();
}
elseif (mysql_num_rows($result1) >0 )
```

```
    {
    $myrow1 = mysql_fetch_array($result1);
    $valid_user = $myrow1["name"];
    session_register("valid_user") ;
    header("Location: index.php?valid_user=$valid_user"); exit();
          }

elseif (mysql_num_rows($result2) >0 )
    {
    $myrow2 = mysql_fetch_array($result2);
    $admin_user = $myrow2["name"];
    session_register("admin_user") ;
    header("Location: admin/index.php?admin_user=$admin_user"); exit();
    }

}
?>
```

2. Web Application Code for Librarian

```
<?php

        $starter = $_GET['starter'];

        if ($starter==""){
        include("librarian_main.php");
        }

        else if ($starter=="stu"){
        include("stu.php");
        }

        else if ($starter=="the"){
        include("the.php");
        }
        else if ($starter=="addd"){
        include("addd.php");
        }
        else if ($starter=="upload_file"){
        include("upload_file.php");
        }
        else if ($starter=="upload"){
        include("upload.php");
        }
        else if ($starter=="editt"){
        include("editt.php");
        }
        else if ($starter=="manfac"){
```

```
        include("manfac.php");
        }

?>
<SCRIPT LANGUAGE="JavaScript">

function doSearch() {
        form1.action = "?action=search&starter=the";
        form1.submit();
}

function doAdd() {
        form1.action = "?action=add&starter=upload_file";
        form1.submit();
}

function doEdit(mode) {
        form1.action = "?action=edit&starter=editt&idid="+mode;
        form1.submit();
}

function doDel(mode) {
        form1.action = "?action=del&starter=editt&idid="+mode;
        form1.submit();
}
</SCRIPT>
```

3. PHP Coding to Upload Theses by Librarian

```
<?php
$target = "../retrieve/";
$target = $target . basename( $_FILES['uploaded']['name']) ;
$ok=1;
if(move_uploaded_file($_FILES['uploaded']['tmp_name'], $target))
{
        $title    = $_POST['title'];
        $author = $_POST['author'];
        $subject = $_POST['subject'];
        $abstract = $_POST['abstract'];
        $keywords = $_POST['keywords'];
        $location = $_POST['location'];
        $date = $_POST['date'];
        $id_fac = $_POST['id_fac'];
        $depositedby = $librarian_user;
        $depositedon = date("Ymd");

        $file = $HTTP_POST_FILES['uploaded']['name'];
        $size = $HTTP_POST_FILES['uploaded']['size'];
```

```
        $sql = "INSERT INTO
thesis(title,author,subject,abstract,keywords,place,date,file,size,depositedby,deposite
don,id_fac)
VALUES('$title','$author','$subject','$abstract','$keywords','$location','$date','$file','$
size','$depositedby','$depositedon','$id_fac')";
        $rs = mysql_query($sql);

echo "The Thesis Information has been uploaded"
?>
<br>
<br>
<?
echo "The Thesis file named ". basename( $_FILES['uploaded']['name']). " has been
uploaded";
}
else {
echo "Sorry, there was a problem uploading your file.";
}
?>
```

4. PHP Coding to Manage Librarian by Administrator

```
<?
$action = $_GET['action'];
$idid = $_GET['idid'];

if ($action == 'save') {

        $add_name = $_POST['add_name'];
        $add_username = $_POST['add_username'];
        $add_password = $_POST['add_password'];

        $sql = "INSERT INTO librarians(name,username,password)
VALUES('$add_name','$add_username','$add_password')";
        $rs = mysql_query($sql);

}

if ($action == 'del') {


        $sql = "DELETE FROM librarians WHERE id_lib='$idid'";
        $rs = mysql_query($sql);
}

if ($action == 'update') {
```

```
	$edit_name = $_POST['edit_name'];
	$edit_username = $_POST['edit_username'];
	$edit_password = $_POST['edit_password'];

	$sql = "UPDATE librarians SET name='$edit_name',
username='$edit_username', password='$edit_password' WHERE id_lib='$idid' ";
	$rs = mysql_query($sql);
}

$sql = "SELECT * from librarians ";
$rs = mysql_query($sql);

?>
```

5. PHP Coding to Search Thesis

```
<?
	$action = $_GET['action'];


	if ($action == 'search') {
	$searchby = $_POST['searchby'];
	$keyword = $_POST['keyword'];


	if ($searchby == '1' || $searchby == '2' || $searchby == '3' || $searchby == '4') {


	if ($searchby == '1'){
	$sql = "select * from thesis, faculty WHERE title like '%$keyword%' and
thesis.id_fac=faculty.id_fac order by date desc ";
	$rs = mysql_query($sql);

	while ($row = mysql_fetch_assoc($rs)) {

	$thesis_id=$row['thesis_id'];
	$id_fac=$row['id_fac'];
	$title=$row['title'];
	$author=$row['author'];
	$subject=$row['subject'];
	$date=$row['date'];
	}
	}

	else if ($searchby == '2'){
	$sql = "select * from thesis, faculty WHERE author like '%$keyword%' and
thesis.id_fac=faculty.id_fac order by date desc ";
	$rs = mysql_query($sql);

	while ($row = mysql_fetch_assoc($rs)) {
```

```
$thesis_id=$row['thesis_id'];
$id_fac=$row['id_fac'];
$title=$row['title'];
$author=$row['author'];
$subject=$row['subject'];
$date=$row['date'];
}
}

else if ($searchby == '3'){
$sql = "select * from thesis, faculty WHERE subject like '%$keyword%' and
thesis.id_fac=faculty.id_fac order by date desc ";
$rs = mysql_query($sql);

while ($row = mysql_fetch_assoc($rs)) {

$thesis_id=$row['thesis_id'];
$id_fac=$row['id_fac'];
$title=$row['title'];
$author=$row['author'];
$subject=$row['subject'];
$date=$row['date'];
}
}

else if ($searchby == '4'){
$sql = "select * from thesis, faculty WHERE (subject like '%$keyword%' or
title like '%$keyword%' or author like '%$keyword%' or abstract like
'%$keyword%' or keywords like '%$keyword%' or place like '%$keyword%'
or faculty like '%$keyword%' or date like '%$keyword%') and
thesis.id_fac=faculty.id_fac order by date desc ";
$rs = mysql_query($sql);

while ($row = mysql_fetch_assoc($rs)) {

$thesis_id=$row['thesis_id'];
$id_fac=$row['id_fac'];
$title=$row['title'];
$author=$row['author'];
$subject=$row['subject'];
$date=$row['date'];
}
}
}
}
?>
```

6. PHP Coding to View the Thesis Detail

```
<?
  $thesis_id = $_GET['thesis_id'];


$sql3 = "select * from thesis, faculty WHERE thesis_id = '$thesis_id' and
thesis.id_fac=faculty.id_fac order by date desc ";
          $rs3 = mysql_query($sql3);

           while ($row3 = mysql_fetch_assoc($rs3)) {

           $title=$row3['title'];
           $author=$row3['author'];
           $subject=$row3['subject'];
           $abstract=$row3['abstract'];
           $keywords=$row3['keywords'];
           $place=$row3['place'];
           $date=$row3['date'];
           $file=$row3['file'];
           $size=$row3['size'];
           $depositedby=$row3['depositedby'];
           $depositedon=$row3['depositedon'];
           $faculty=$row3['faculty'];
           $id_fac = $row3['id_fac'];
           }

?>
```

APPENDIX F

User Acceptance Test Questionnaires

Please rank each of the following system features according to the listed criteria:

1 – Strongly disagree

2 – Disagree

3 – OK/No comment

4 – Agree

5 – Strongly agree

System Features	1	2	3	4	5
Do you agree that the system is easy to navigate?					
Do you agree that the system functionalities are meeting your requirements?					
Do you agree that the system functionalities are complete?					
Do you agree that the system design is acceptable and appropriate?					
Do you agree that the system design is attractive and looks professional?					
Do you agree that the system search possibilities are good?					
Do you agree that the information/data presented in the system is enough?					

Additional comments / remarks:

_____

_____

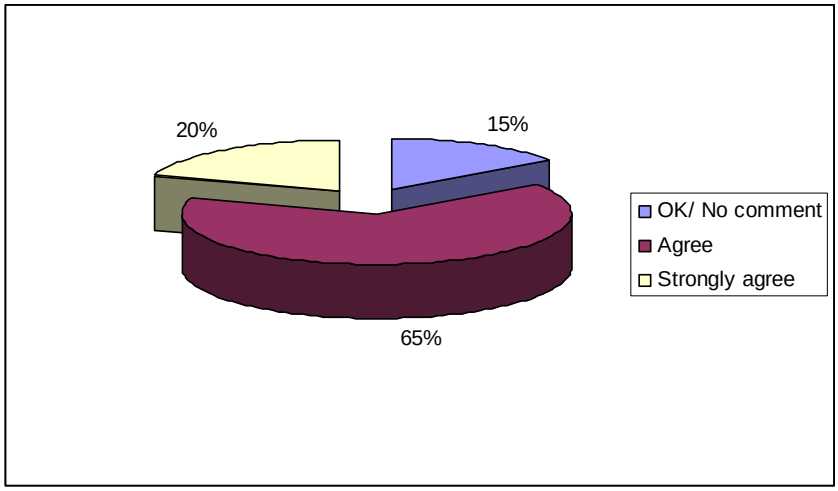
Signature: ……

Name: ( )

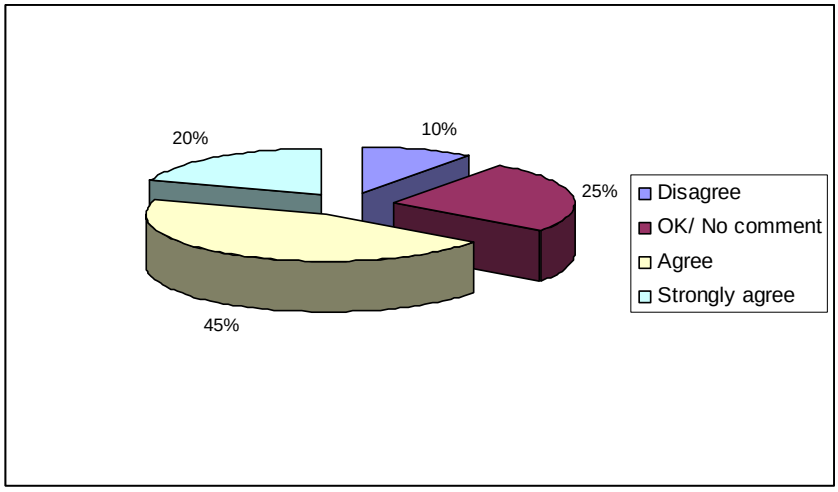
Date: _____

The questionnaire forms were given to 20 students, users of UTM Library. Based on survey, the results are:

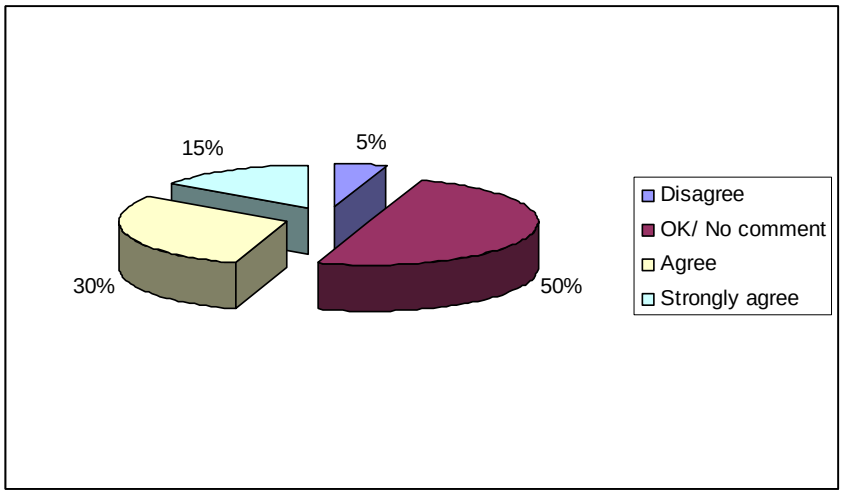
1. Do you agree that the system is easy to navigate?



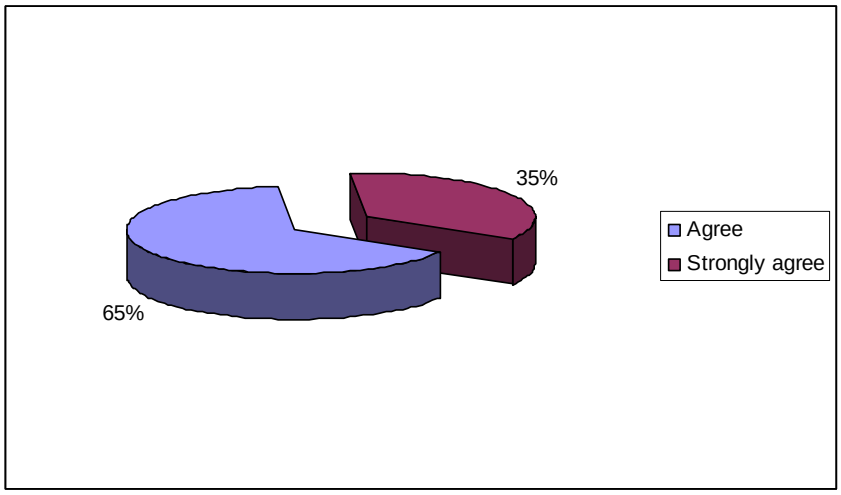
2. Do you agree that the system functionalities are meeting your requirements?



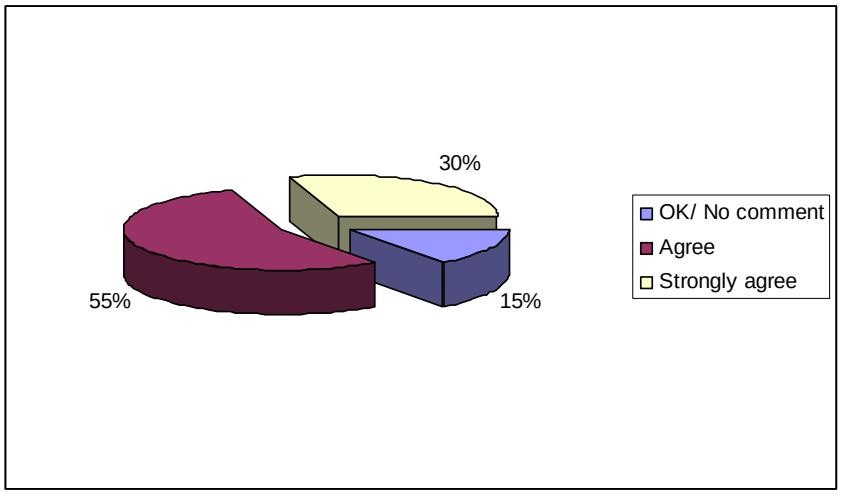
3. Do you agree that the system functionalities are complete?



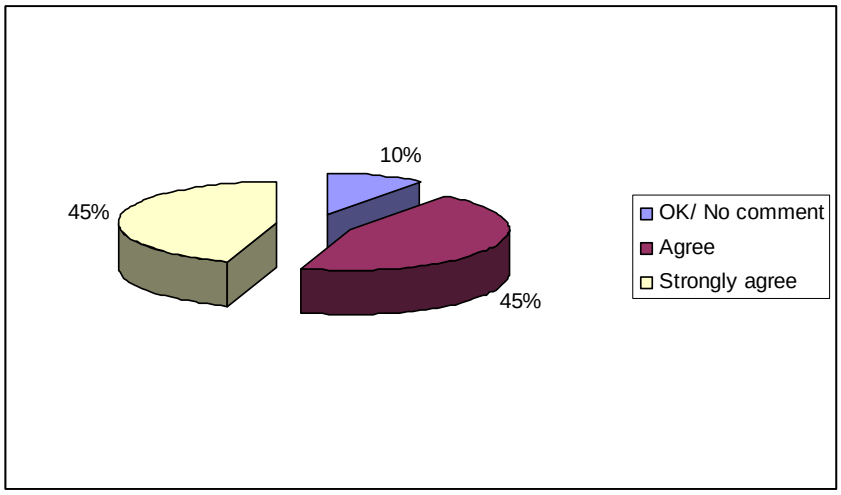
4. Do you agree that the system design is acceptable and appropriate?



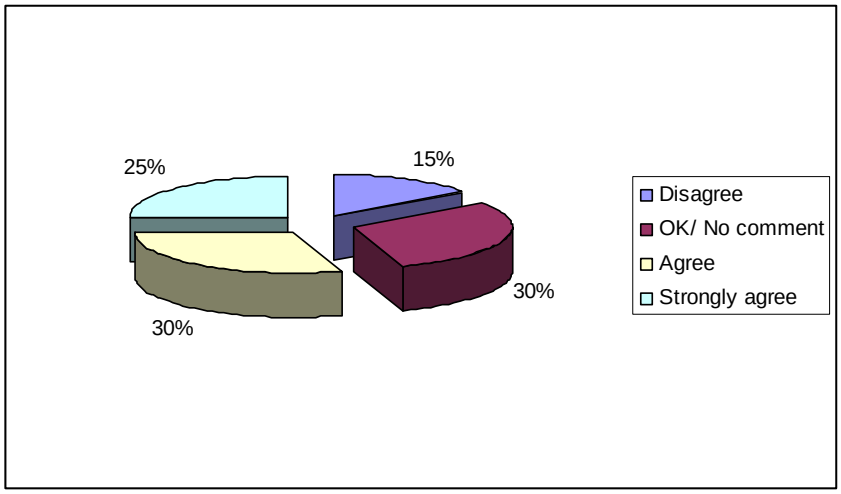
5. Do you agree that the system design is attractive and looks professional?



6. Do you agree that the system search possibilities are good?



7. Do you agree that the information/data presented in the system is enough?



APPENDIX G

5 samples of user's feedback

User Acceptance Test Questionnaires

Please rank each of the following system features according to the listed criteria:

1 – Strongly disagree

2 – Disagree

3 – OK/No comment

4 – Agree

5 – Strongly agree

System Features	1	2	3	4	5
Do you agree that the system is easy to navigate?					✓
Do you agree that the system functionalities are meeting your requirements?					✓
Do you agree that the system functionalities are complete?			✓		
Do you agree that the system design is acceptable and appropriate?				✓	
Do you agree that he system design is attractive and looks professional?				✓	
Do you agree that system search possibilities are good?					✓
Do you agree that the information/data presented in the system is enough?				✓	

Additional comments / remarks;

I believe with having more time the developer will be able to deliver a First Class System as I can see the concept is there.

Signature: .....

Name: (Rabia Ibrahim)

Date: 06 – 09 – 2008

User Acceptance Test Questionnaires

Please rank each of the following system features according to the listed criteria:

1 – Strongly disagree

2 – Disagree

3 – OK/No comment

4 – Agree

5 – Strongly agree

System Features	1	2	3	4	5
Do you agree that the system is easy to navigate?				✓	
Do you agree that the system functionalities are meeting your requirements?				✓	
Do you agree that the system functionalities are complete?		✓			
Do you agree that the system design is acceptable and appropriate?					✓
Do you agree that the system design is attractive and looks professional?				✓	
Do you agree that the system search possibilities are good?			✓		
Do you agree that the information/data presented in the system is enough?			✓		

Additional comments / remarks:

(1.) No message if there is no result in data-base

(2) No message if search by is not selected.

(3) The results are shown at the bottom half of the page, which in Searching quickly will be problematic/matter of user friendliness

(4) more information items in search results would be better.

Signature: S.A. Zia

Name: (Syyed Ali Zian)

Date: 10.4.09

User Acceptance Test Questionnaires

Please rank each of the following system features according to the listed criteria:

1 – Strongly disagree

2 – Disagree

3 – OK/No comment

4 – Agree

5 – Strongly agree

System Features	1	2	3	4	5
Do you agree that the system is easy to navigate?				✓	
Do you agree that the system functionalities are meeting your requirements?				✓	
Do you agree that the system functionalities are complete?					✓
Do you agree that the system design is acceptable and appropriate?					✓
Do you agree that the system design is attractive and looks professional?				✓	
Do you agree that the system search possibilities are good?				✓	
Do you agree that the information/data presented in the system is enough?					✓

Additional comments / remarks:

A link should be created for external link to other library's data base.
— like PSZ KL campus
— other internationally ~~Recorded~~ recognised Uni.

Signature: .....

Name: (Okicha-Ann.)

Date: 9/4/09

User Acceptance Test Questionnaires

Please rank each of the following system features according to the listed criteria:

1 – Strongly disagree

2 – Disagree

3 – OK/No comment

4 – Agree

5 – Strongly agree

System Features	1	2	3	4	5
Do you agree that the system is easy to navigate?				✓	
Do you agree that the system functionalities are meeting your requirements?				✓	
Do you agree that the system functionalities are complete?					✓
Do you agree that the system design is acceptable and appropriate?				✓	
Do you agree that the system design is attractive and looks professional?					✓
Do you agree that the system search possibilities are good?					✓
Do you agree that the information/data presented in the system is enough?					✓

Additional comments / remarks:

- The System should be implemented immediately so that all students, teachers can befit benefit from system Service

Signature: .....

Name: ( )

Date: 19.04.09

User Acceptance Test Questionnaires

Please rank each of the following system features according to the listed criteria:

1 – Strongly disagree

2 – Disagree

3 – OK/No comment

4 – Agree

5 – Strongly agree

System Features	1	2	3	4	5
Do you agree that the system is easy to navigate?					✓
Do you agree that the system functionalities are meeting your requirements?					✓
Do you agree that the system functionalities are complete?			✓		
Do you agree that the system design is acceptable and appropriate?				✓	
Do you agree that the system design is attractive and looks professional?				✓	
Do you agree that the system search possibilities are good?				✓	
Do you agree that the information/data presented in the system is enough?			✓		

Additional comments / remarks:

It is ok for FSZ to have a separated system for digital material beside IR that already adopted. Suggested to have this specially for digital thesis and easy for students to get access.

Signature: .....

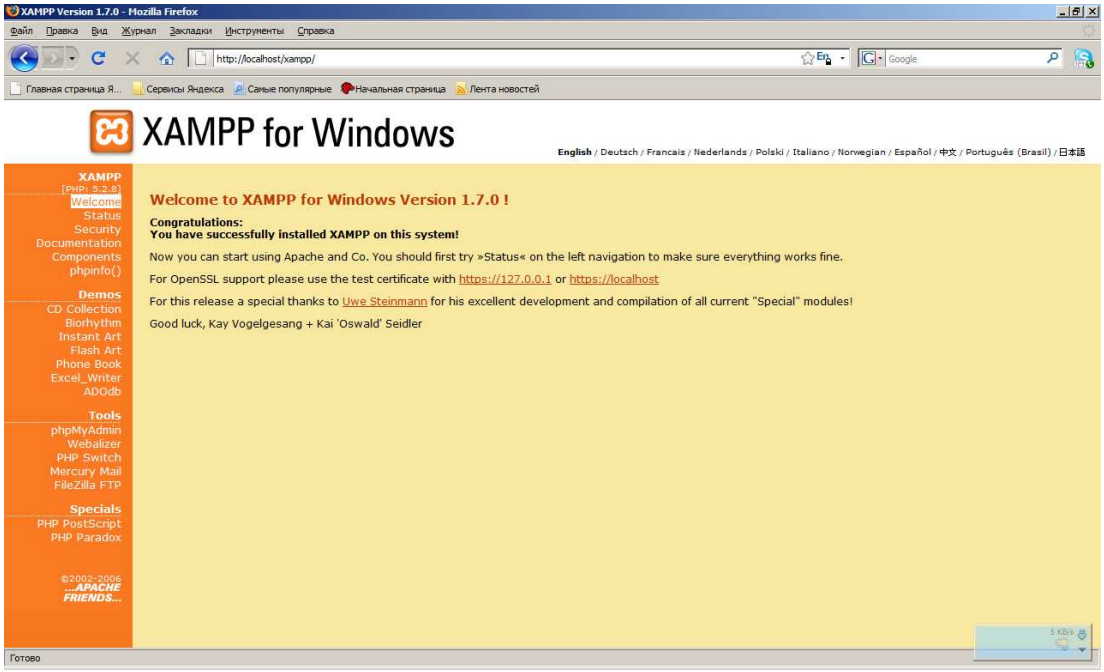
Name: (BADARIAH BORHAN

Date: 09.04.09

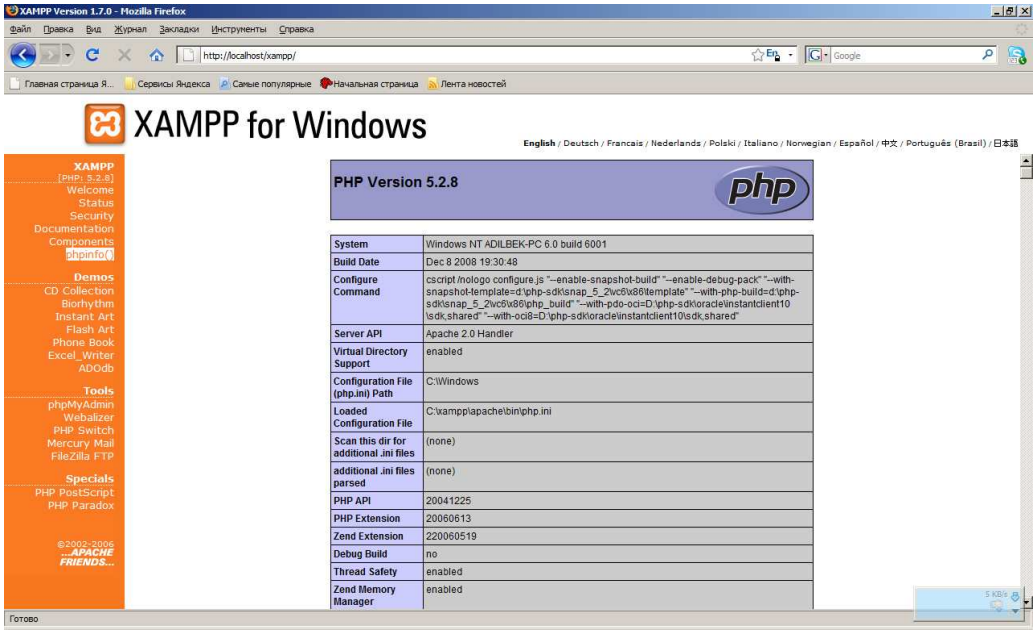
APPENDIX H

User Manual and Technical Documentation

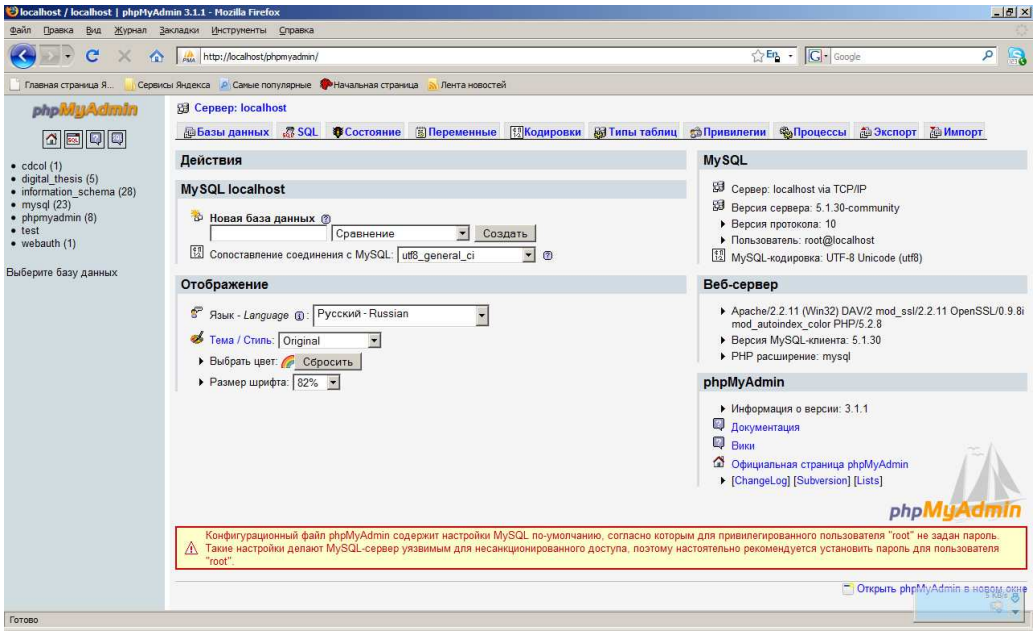
1. Installing Apache Server, PHP and MySQL
   a. Get from the CD or download file xampp-win32-1.7.0-installer from http://internode.dl.sourceforge.net/sourceforge/xampp/xampp-win32-1.7.0-installer.exe and install it to the operation system used. XAMPP is an easy to install Apache distribution containing MySQL, PHP and Perl.
2. Test Your XAMPP Installation.
   a. To make sure that apache server is working type *localhost* at the browser and you will see the following window:


XAMPP Version 1.7.0 - Mozilla Firefox
http://localhost/xampp/
XAMPP for Windows
English / Deutsch / Francais / Nederlands / Polski / Italiano / Norwegian / Español / 中文 / Português (Brasil) / 日本語
XAMPP
Welcome
Status
Security
Documentation
Components
phpinfo()
Demos
CD Collection
Biorhythm
Instant Art
Flash Art
Phone Book
Excel_Writer
ADOdb
Tools
phpMyAdmin
Webalizer
PHP Switch
Mercury Mail
FileZilla FTP
Specials
PHP PostScript
PHP Paradox
Welcome to XAMPP for Windows Version 1.7.0 !
Congratulations:
You have successfully installed XAMPP on this system!
Now you can start using Apache and Co. You should first try »Status« on the left navigation to make sure everything works fine.
For OpenSSL support please use the test certificate with https://127.0.0.1 or https://localhost
For this release a special thanks to Uwe Steinmann for his excellent development and compilation of all current "Special" modules!
Good luck, Kay Vogelgesang + Kai 'Oswald' Seidler
Готово

b. To make sure that PHP is installed properly press phpinfo() link from left menu of XAMPP main page and next window will appear as shown below:



c. To check your MySQL installation select phpMyAdmin tool from left navigation menu and following window appear as shown below:



3. Installing Document Management and Filing Archival System.

a. Copy **digital_thesis** folder located in the CD to home directory of php, as default located in C:\xampp\htdocs

b. Copy database folder **digital_thesis** located in the CD:\DB\ to C:\xampp\mysql\data

4. After everything done, the system is ready to use.

User Manual for PSZ Library users (UTM students)

1. Main page of the system

The main page of the system consists of 3 parts. Left part contains such links as *Home, Top Visited Theses, Browse by Faculty, Browse by Author, Browse by Title, Browse by Subject, Browse by Year.* Also it contain a login form below links. Central part contain *Search Thesis* field. Right part of the system shows *5 Recent added theses.*

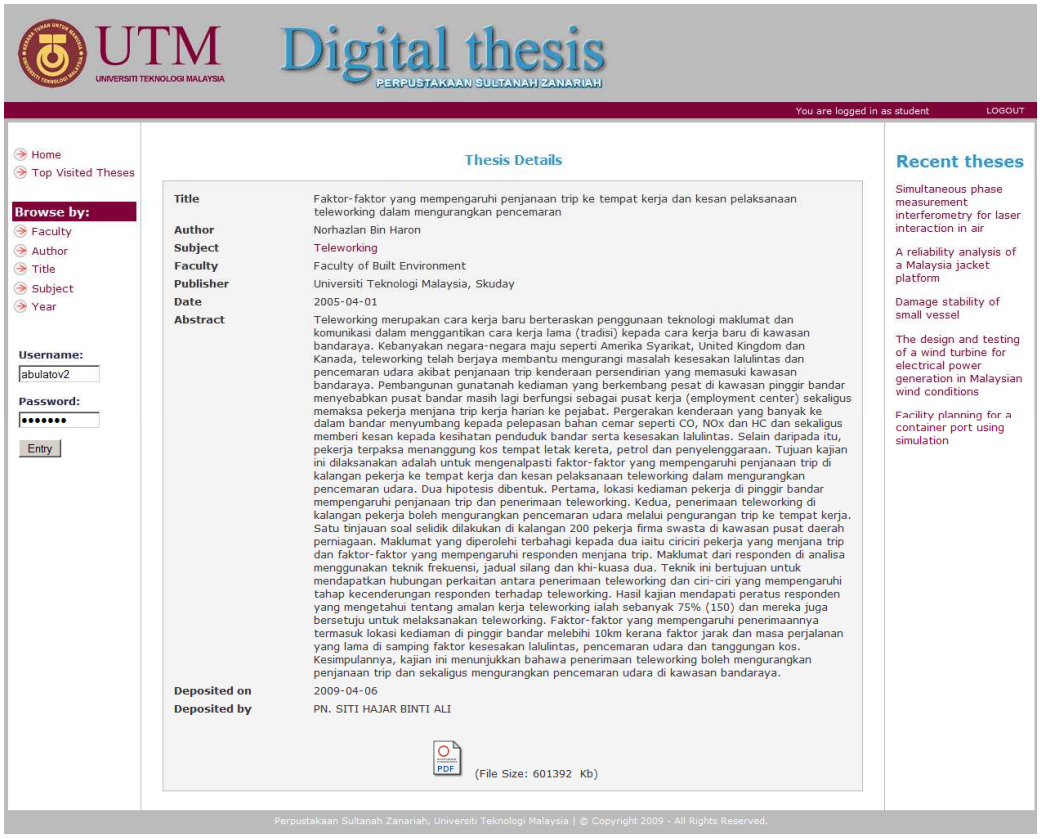
2. Top Visited Theses.

To view this page click *Top Visited Theses* link from left menu panel.

UTM
UNIVERSITI TEKNOLOGI MALAYSIA
Digital thesis
PERPUSTAKAAN SULTANAH ZANARIAH
You are logged in as student
LOGOUT
Home
Top Visited Theses
Browse by:
Faculty
Author
Title
Subject
Year
Username:
abulatov2
Password:
Entry
Top 10 Visited Thesis
Year
Title
Faculty
Hits
2008 Environmental learning and higher education: A study of learning environments using place-based and constructive pedagogies
Faculty of Education
28
1971 Electrical conduction in niobium selenide
Faculty of Electrical Engineering
12
2006 Internet protocol (IP) speakerphone reference design
Faculty of Computer Science and Information System
8
2006 Simultaneous phase measurement interferometry for laser interaction in air
Faculty of Science
6
1995 Sustaining engineering : rationale and directions for preparing engineers for sustainable development
Faculty of Built Environment
4
2005 Pembanguan kiosk maklumat kawalan pembangunan berasaskan web GIS bagi perancangan dan pengurusan bandar
Faculty of Built Environment
4
2006 Pengoptimuman skema logical pangkalan data hubungan: kajan kes pangkalan data system maklumat hidrologi Malaysia
Faculty of Computer Science and Information System
3
1995 Aspiration, adaptation, and invocation : a pidginization-based model of transition within the built environment of Northwest coast towns
Faculty of Built Environment
2
1993 Electrical characteristics of polymer-based field effect transistors
Faculty of Electrical Engineering
2
2005 Faktor-faktor yang mempengaruhi penjanaan trip ke tempat kerja dan kesan pelaksanaan teleworking dalam mengurangkan pencemaran
Faculty of Built Environment
2
Recent theses
Simultaneous phase measurement interferometry for laser interaction in air
A reliability analysis of a Malaysia jacket platform
Damage stability of small vessel
The design and testing of a wind turbine for electrical power generation in Malaysian wind conditions
Facility planning for a container port using simulation
Perpustakaan Sultanah Zanariah, Universiti Teknologi Malaysia | © Copyright 2009 - All Rights Reserved.

3. View thesis details.

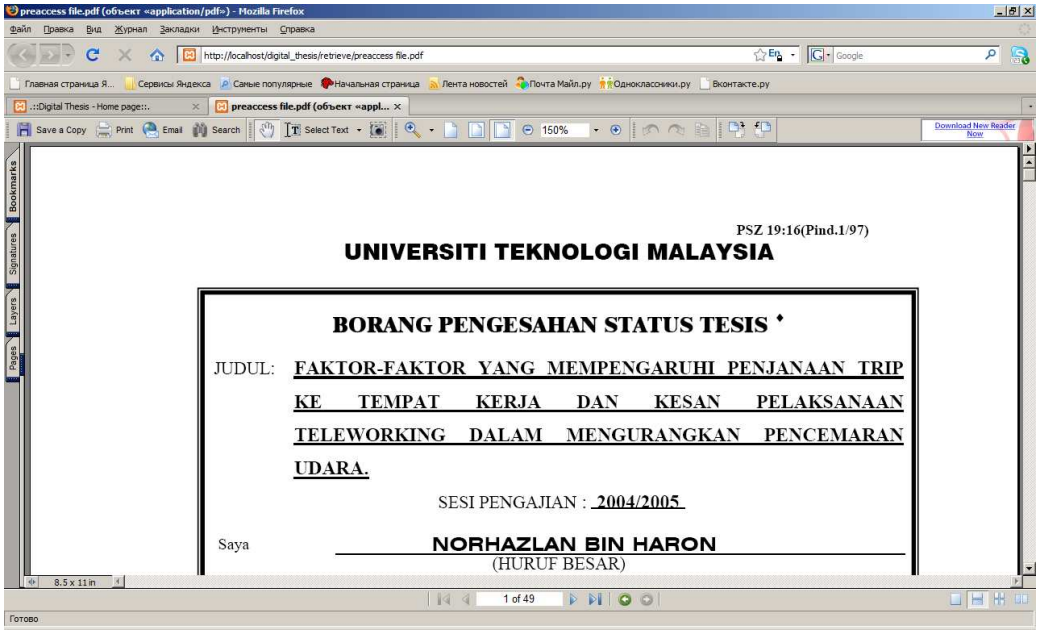
To view thesis details from *Top 10 Visited Theses* click on any title of thesis


UTM
UNIVERSITI TEKNOLOGI MALAYSIA
Digital thesis
PERPUSTAKAAN SULTANAH ZANARIAH
You are logged in as student
LOGOUT
Home
Top Visited Theses
Browse by:
Faculty
Author
Title
Subject
Year
Username:
abulatov2
Password:
Entry
Thesis Details
Title
Faktor-faktor yang mempengaruhi penjanaan trip ke tempat kerja dan kesan pelaksanaan teleworking dalam mengurangkan pencemaran
Author
Norhazlan Bin Haron
Subject
Teleworking
Faculty
Faculty of Built Environment
Publisher
Universiti Teknologi Malaysia, Skuday
Date
2005-04-01
Abstract
Teleworking merupakan cara kerja baru berteraskan penggunaan teknologi maklumat dan komunikasi dalam menggantikan cara kerja lama (tradisi) kepada cara kerja baru di kawasan bandaraya. Kebanyakan negara-negara maju seperti Amerika Syarikat, United Kingdom dan Kanada, teleworking telah berjaya membantu mengurangi masalah kesesakan lalulintas dan pencemaran udara akibat penjanaan trip kenderaan persendirian yang memasuki kawasan bandaraya. Pembangunan gunatanah kediaman yang berkembang pesat di kawasan pinggir bandar menyebabkan pusat bandar masih lagi berfungsi sebagai pusat kerja (employment center) sekaligus memaksa pekerja menjana trip kerja harian ke pejabat. Pergerakan kenderaan yang banyak ke dalam bandar menyumbang kepada pelepasan bahan cemar seperti CO, NOx dan HC dan sekaligus memberi kesan kepada kesihatan penduduk bandar serta kesesakan lalulintas. Selain daripada itu, pekerja terpaksa menanggung kos tempat letak kereta, petrol dan penyelenggaraan. Tujuan kajian ini dilaksanakan adalah untuk mengenalpasti faktor-faktor yang mempengaruhi penjanaan trip di kalangan pekerja ke tempat kerja dan kesan pelaksanaan teleworking dalam mengurangkan pencemaran udara. Dua hipotesis dibentuk. Pertama, lokasi kediaman pekerja di pinggir bandar mempengaruhi penjanaan trip dan penerimaan teleworking. Kedua, penerimaan teleworking di kalangan pekerja boleh mengurangkan pencemaran udara melalui pengurangan trip ke tempat kerja. Satu tinjauan soal selidik dilakukan di kalangan 200 pekerja firma swasta di kawasan pusat daerah perniagaan. Maklumat yang diperolehi terbahagi kepada dua iaitu ciriciri pekerja yang menjana trip dan faktor-faktor yang mempengaruhi responden menjana trip. Maklumat dari responden di analisa menggunakan teknik frekuensi, jadual silang dan khi-kuasa dua. Teknik ini bertujuan untuk mendapatkan hubungan perkaitan antara penerimaan teleworking dan ciri-ciri yang mempengaruhi tahap kecenderungan responden terhadap teleworking. Hasil kajian mendapati peratus responden yang mengetahui tentang amalan kerja teleworking ialah sebanyak 75% (150) dan mereka juga bersetuju untuk melaksanakan teleworking. Faktor-faktor yang mempengaruhi penerimaannya termasuk lokasi kediaman di pinggir bandar melebihi 10km kerana faktor jarak dan masa perjalanan yang lama di samping faktor kesesakan lalulintas, pencemaran udara dan tanggungan kos. Kesimpulannya, kajian ini menunjukkan bahawa penerimaan teleworking boleh mengurangkan penjanaan trip dan sekaligus mengurangkan pencemaran udara di kawasan bandaraya.
Deposited on
2009-04-06
Deposited by
PN. SITI HAJAR BINTI ALI
PDF
(File Size: 601392 Kb)
Recent theses
Simultaneous phase measurement interferometry for laser interaction in air
A reliability analysis of a Malaysia jacket platform
Damage stability of small vessel
The design and testing of a wind turbine for electrical power generation in Malaysian wind conditions
Facility planning for a container port using simulation
Perpustakaan Sultanah Zanariah, Universiti Teknologi Malaysia | © Copyright 2009 - All Rights Reserved.

This figure illustrates thesis details such as *Title*, *Author*, *Subject*, *Faculty*, *Publisher*, *Date*, and *Abstract.*

4. View the whole thesis.

Click on *PDF* icon from previous window


PSZ 19:16(Pind.1/97)
UNIVERSITI TEKNOLOGI MALAYSIA
BORANG PENGESAHAN STATUS TESIS
JUDUL: FAKTOR-FAKTOR YANG MEMPENGARUHI PENJANAAN TRIP KE TEMPAT KERJA DAN KESAN PELAKSANAAN TELEWORKING DALAM MENGURANGKAN PENCEMARAN UDARA.
SESI PENGAJIAN : 2004/2005
Saya NORHAZLAN BIN HARON
(HURUF BESAR)

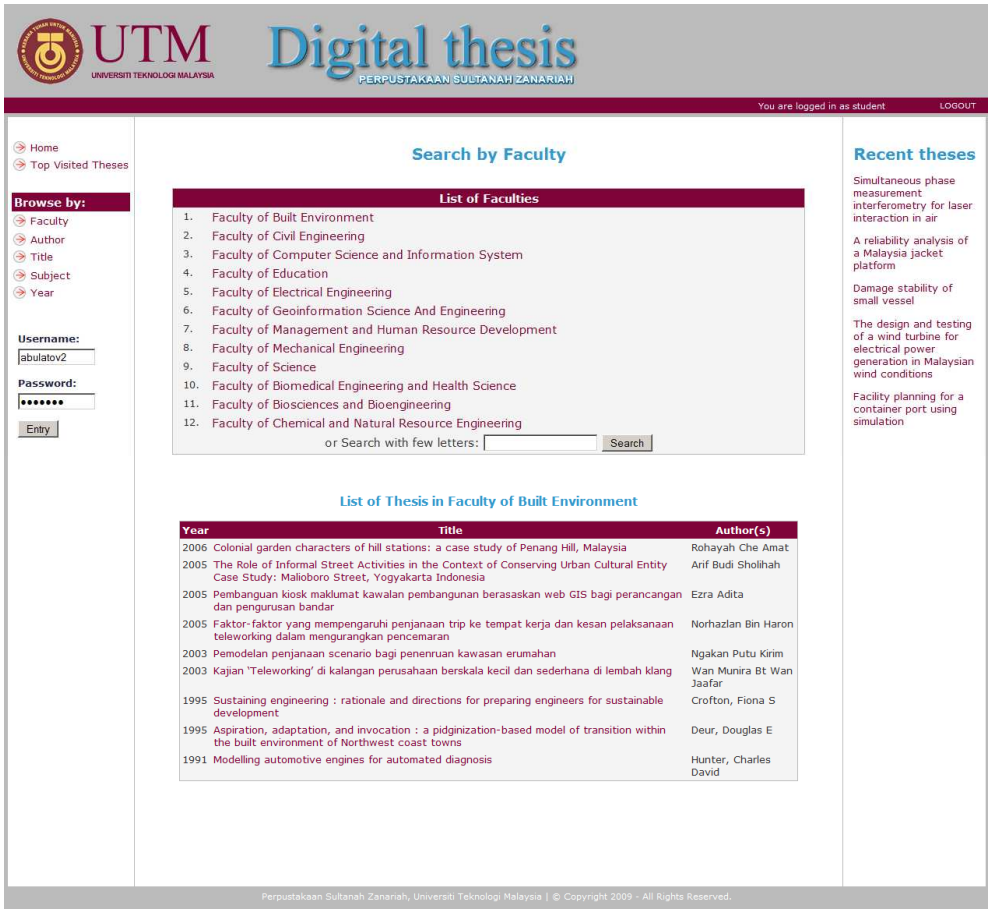
5. Browse by Faculty

a) Click on *Browse by Faculty* link from left menu panel

UTM
UNIVERSITI TEKNOLOGI MALAYSIA
Digital thesis
PERPUSTAKAAN SULTANAH ZANARIAH
You are logged in as student
LOGOUT
Home
Top Visited Theses
Browse by:
Faculty
Author
Title
Subject
Year
Username:
abulatov2
Password:
Entry
Search by Faculty
List of Faculties
1. Faculty of Built Environment
2. Faculty of Civil Engineering
3. Faculty of Computer Science and Information System
4. Faculty of Education
5. Faculty of Electrical Engineering
6. Faculty of Geoinformation Science And Engineering
7. Faculty of Management and Human Resource Development
8. Faculty of Mechanical Engineering
9. Faculty of Science
10. Faculty of Biomedical Engineering and Health Science
11. Faculty of Biosciences and Bioengineering
12. Faculty of Chemical and Natural Resource Engineering
or Search with few letters:
Search
Recent theses
Simultaneous phase measurement interferometry for laser interaction in air
A reliability analysis of a Malaysia jacket platform
Damage stability of small vessel
The design and testing of a wind turbine for electrical power generation in Malaysian wind conditions
Facility planning for a container port using simulation

This figure illustrates a list of faculties of UTM. Each faculty title serves as a link by clicking which you can see the list of theses from appropriate faculty. See figure below.

b) Click on *Faculty of Built Environment* (exapmle)


UTM
UNIVERSITI TEKNOLOGI MALAYSIA
Digital thesis
PERPUSTAKAAN SULTANAH ZANARIAH
You are logged in as student
LOGOUT
Home
Top Visited Theses
Browse by:
Faculty
Author
Title
Subject
Year
Username:
abulatov2
Password:
Entry
Search by Faculty
List of Faculties
1. Faculty of Built Environment
2. Faculty of Civil Engineering
3. Faculty of Computer Science and Information System
4. Faculty of Education
5. Faculty of Electrical Engineering
6. Faculty of Geoinformation Science And Engineering
7. Faculty of Management and Human Resource Development
8. Faculty of Mechanical Engineering
9. Faculty of Science
10. Faculty of Biomedical Engineering and Health Science
11. Faculty of Biosciences and Bioengineering
12. Faculty of Chemical and Natural Resource Engineering
or Search with few letters:
Search
List of Thesis in Faculty of Built Environment
Year
Title
Author(s)
2006 Colonial garden characters of hill stations: a case study of Penang Hill, Malaysia
Rohayah Che Amat
2005 The Role of Informal Street Activities in the Context of Conserving Urban Cultural Entity Case Study: Malioboro Street, Yogyakarta Indonesia
Arif Budi Sholihah
2005 Pembanguan kiosk maklumat kawalan pembangunan berasaskan web GIS bagi perancangan dan pengurusan bandar
Ezra Adita
2005 Faktor-faktor yang mempengaruhi penjanaan trip ke tempat kerja dan kesan pelaksanaan teleworking dalam mengurangkan pencemaran
Norhazlan Bin Haron
2003 Pemodelan penjanaan scenario bagi penenruan kawasan erumahan
Ngakan Putu Kirim
2003 Kajian 'Teleworking' di kalangan perusahaan berskala kecil dan sederhana di lembah klang
Wan Munira Bt Wan Jaafar
1995 Sustaining engineering : rationale and directions for preparing engineers for sustainable development
Crofton, Fiona S
1995 Aspiration, adaptation, and invocation : a pidginization-based model of transition within the built environment of Northwest coast towns
Deur, Douglas E
1991 Modelling automotive engines for automated diagnosis
Hunter, Charles David
Recent theses
Simultaneous phase measurement interferometry for laser interaction in air
A reliability analysis of a Malaysia jacket platform
Damage stability of small vessel
The design and testing of a wind turbine for electrical power generation in Malaysian wind conditions
Facility planning for a container port using simulation
Perpustakaan Sultanah Zanariah, Universiti Teknologi Malaysia | © Copyright 2009 - All Rights Reserved.

6. Browse by Author

a) Click on *Browse by Author* link from left menu panel

UTM
UNIVERSITI TEKNOLOGI MALAYSIA
Digital thesis
PERPUSTAKAAN SULTANAH ZANARIAH
You are logged in as student
LOGOUT
Home
Top Visited Theses
Browse by:
Faculty
Author
Title
Subject
Year
Username:
abulatov2
Password:
Entry
Search by Author
Jump to: 0-9 A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
or Search with few letters:
Search
Recent theses
Simultaneous phase measurement interferometry for laser interaction in air
A reliability analysis of a Malaysia jacket platform
Damage stability of small vessel
The design and testing of a wind turbine for electrical power generation in Malaysian wind conditions
Facility planning for a container port using simulation

To view a list of theses browsed by author click on any alphabet.

b) Click on *A* letter (example)

UTM
UNIVERSITI TEKNOLOGI MALAYSIA
Digital thesis
PERPUSTAKAAN SULTANAH ZANARIAH
You are logged in as student
LOGOUT
Home
Top Visited Theses
Browse by:
Faculty
Author
Title
Subject
Year
Username:
abulatov2
Password:
Entry
Search by Author
Jump to: 0-9 A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
or Search with few letters:
Search
List of Thesis in first Author letter is A
Year
Title
Author(s)
2006
Danger theory metaphor in artificial immune system for system call data
Anjum Iqbal
2006
Simultaneous phase measurement interferometry for laser interaction in air
Asiah Binti Yahaya
2006
Precise geoid determination for the United Arab Emirates (U.A.E.)
Adel Khaleefa Naseeb Khamis
2005
The Role of Informal Street Activities in the Context of Conserving Urban Cultural Entity Case Study: Malioboro Street, Yogyakarta Indonesia
Arif Budi Sholihah
2005
Facility planning for a container port using simulation
Aruluman Al Ramasamy
Recent theses
Simultaneous phase measurement interferometry for laser interaction in air
A reliability analysis of a Malaysia jacket platform
Damage stability of small vessel
The design and testing of a wind turbine for electrical power generation in Malaysian wind conditions
Facility planning for a container port using simulation

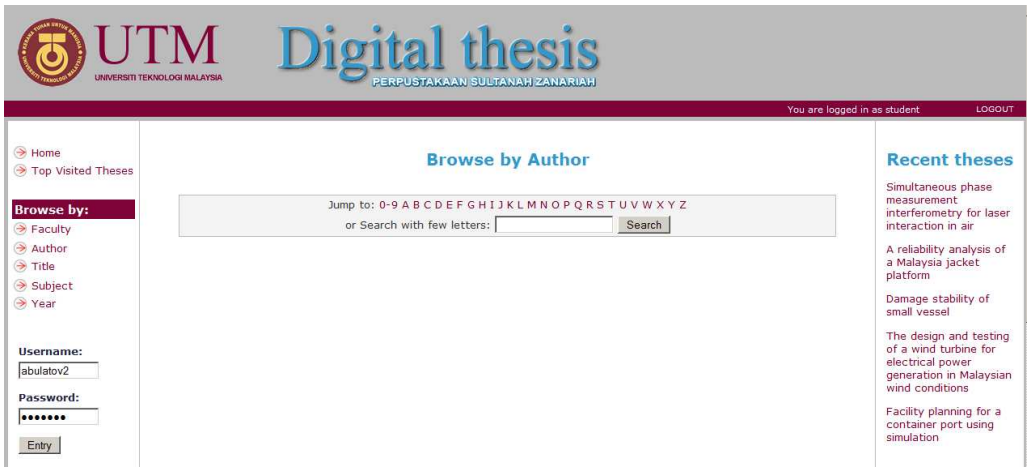
Or you can type in *Search with few letters* field

c) Type *Imran* (example)

UTM
UNIVERSITI TEKNOLOGI MALAYSIA
Digital thesis
PERPUSTAKAAN SULTANAH ZANARIAH
You are logged in as student
LOGOUT
Home
Top Visited Theses
Browse by:
Faculty
Author
Title
Subject
Year
Username:
abulatov2
Password:
Search by Author
Jump to: 0-9 A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
or Search with few letters:
Search
List of Thesis in Author like "Imran"
Year
Title
Author(s)
2006
Real-time response techniques for multi-user interaction in collaborative virtual environments
Imran Chani
Recent theses
Simultaneous phase measurement interferometry for laser interaction in air
A reliability analysis of a Malaysia jacket platform
Damage stability of small vessel
The design and testing of a wind turbine for electrical power generation in Malaysian wind conditions
Facility planning for a container port using

7 Browse by Title

a) Click on *Browse by Title* link from left menu panel


UTM
UNIVERSITI TEKNOLOGI MALAYSIA
Digital thesis
PERPUSTAKAAN SULTANAH ZANARIAH
You are logged in as student
LOGOUT
Home
Top Visited Theses
Browse by:
Faculty
Author
Title
Subject
Year
Username:
abulatov2
Password:
Entry
Browse by Author
Jump to: 0-9 A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
or Search with few letters:
Search
Recent theses
Simultaneous phase measurement interferometry for laser interaction in air
A reliability analysis of a Malaysia jacket platform
Damage stability of small vessel
The design and testing of a wind turbine for electrical power generation in Malaysian wind conditions
Facility planning for a container port using simulation

To view a list of theses browsed by title click on any alphabet.

b) Click on *C* letter (example)

UTM
UNIVERSITI TEKNOLOGI MALAYSIA
Digital thesis
PERPUSTAKAAN SULTANAH ZANARIAH
You are logged in as student
LOGOUT
Home
Top Visited Theses
Browse by:
Faculty
Author
Title
Subject
Year
Username:
abulatov2
Password:
Entry
Browse by Author
Jump to: 0-9 A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
or Search with few letters:
Search
List of Thesis in first Author letter is C
Year
Title
Author(s)
2006
The design and testing of a wind turbine for electrical power generation in Malaysian wind conditions
Ching Wen Tong
2006
Using geographical information system - multiple regression analysis – generated location value response surface approach to model locational factor in the prediction of residential property values
Chin Chui Vui
2005
An admission control method for IEEE 802.11e contention access mechanism
Cheng Weng Cheow
1995
Sustaining engineering : rationale and directions for preparing engineers for sustainable development
Crofton, Fiona S
Recent theses
Simultaneous phase measurement interferometry for laser interaction in air
A reliability analysis of a Malaysia jacket platform
Damage stability of small vessel
The design and testing of a wind turbine for electrical power generation in Malaysian wind conditions
Facility planning for a container port using simulation

Or you can type in *Search with few letters* field

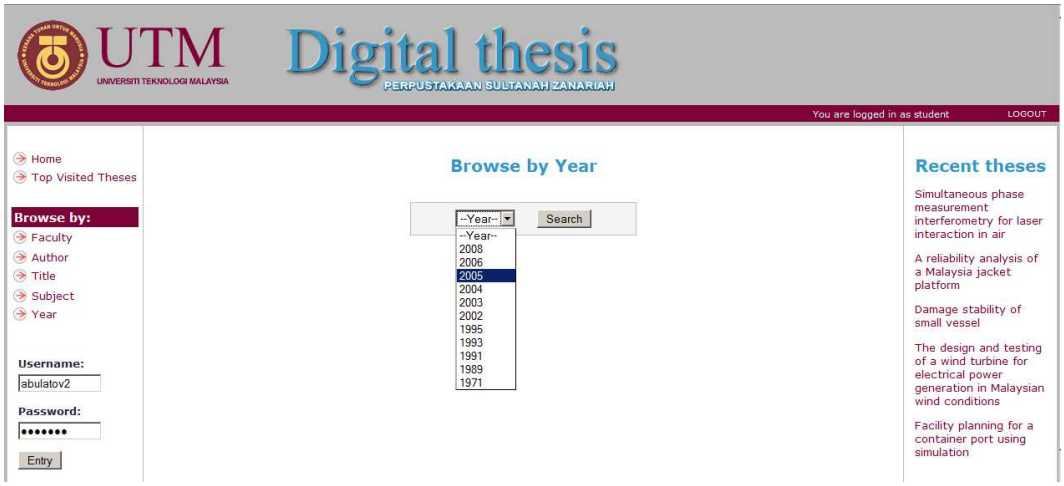
c) Type *Damage* (example)

8 Browse by Subject

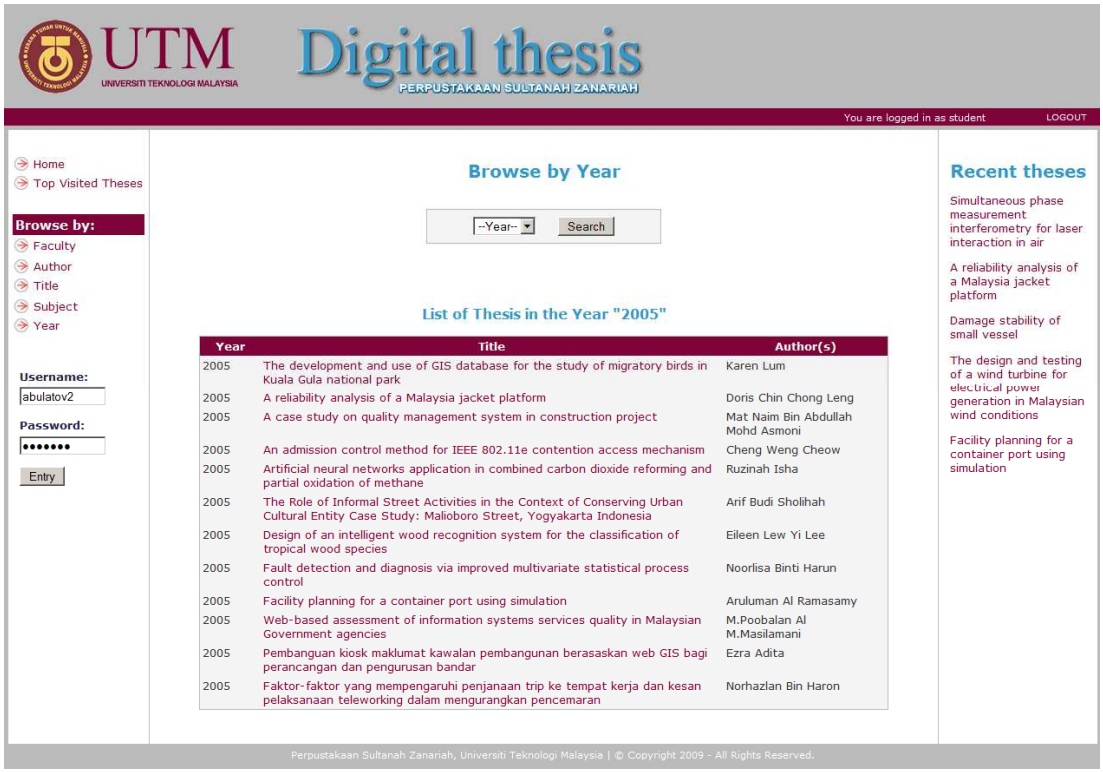
The users should take same actions to browse digital retrospective collection by Subject as in previous windows.

9 Browse by Year

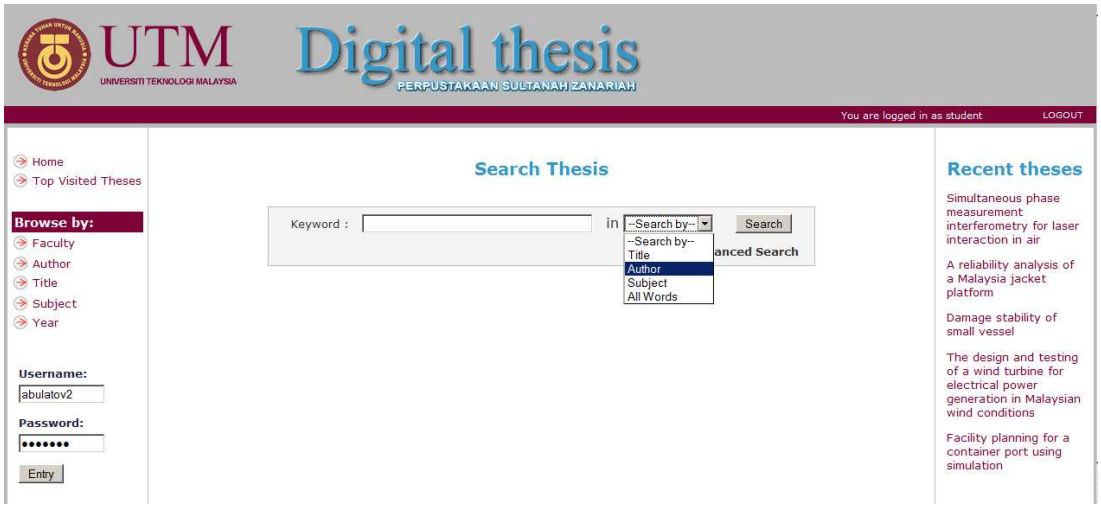
a) Click on *Browse byYear* link from left menu panel



b) Select any year from the list. *2005* (example)


UTM
UNIVERSITI TEKNOLOGI MALAYSIA
Digital thesis
PERPUSTAKAAN SULTANAH ZANARIAH
You are logged in as student
LOGOUT
Home
Top Visited Theses
Browse by:
Faculty
Author
Title
Subject
Year
Username:
abulatov2
Password:
Entry
Browse by Year
--Year--
Search
List of Thesis in the Year "2005"
Year
Title
Author(s)
2005 The development and use of GIS database for the study of migratory birds in Kuala Gula national park Karen Lum
2005 A reliability analysis of a Malaysia jacket platform Doris Chin Chong Leng
2005 A case study on quality management system in construction project Mat Naim Bin Abdullah Mohd Asmoni
2005 An admission control method for IEEE 802.11e contention access mechanism Cheng Weng Cheow
2005 Artificial neural networks application in combined carbon dioxide reforming and partial oxidation of methane Ruzinah Isha
2005 The Role of Informal Street Activities in the Context of Conserving Urban Cultural Entity Case Study: Malioboro Street, Yogyakarta Indonesia Arif Budi Sholihah
2005 Design of an intelligent wood recognition system for the classification of tropical wood species Eileen Lew Yi Lee
2005 Fault detection and diagnosis via improved multivariate statistical process control Noorlisa Binti Harun
2005 Facility planning for a container port using simulation Aruluman Al Ramasamy
2005 Web-based assessment of information systems services quality in Malaysian Government agencies M.Poobalan Al M.Masilamani
2005 Pembanguan kiosk maklumat kawalan pembangunan berasaskan web GIS bagi perancangan dan pengurusan bandar Ezra Adita
2005 Faktor-faktor yang mempengaruhi penjanaan trip ke tempat kerja dan kesan pelaksanaan teleworking dalam mengurangkan pencemaran Norhazlan Bin Haron
Recent theses
Simultaneous phase measurement interferometry for laser interaction in air
A reliability analysis of a Malaysia jacket platform
Damage stability of small vessel
The design and testing of a wind turbine for electrical power generation in Malaysian wind conditions
Facility planning for a container port using simulation
Perpustakaan Sultanah Zanariah, Universiti Teknologi Malaysia | © Copyright 2009 - All Rights Reserved.

10. Basic Search

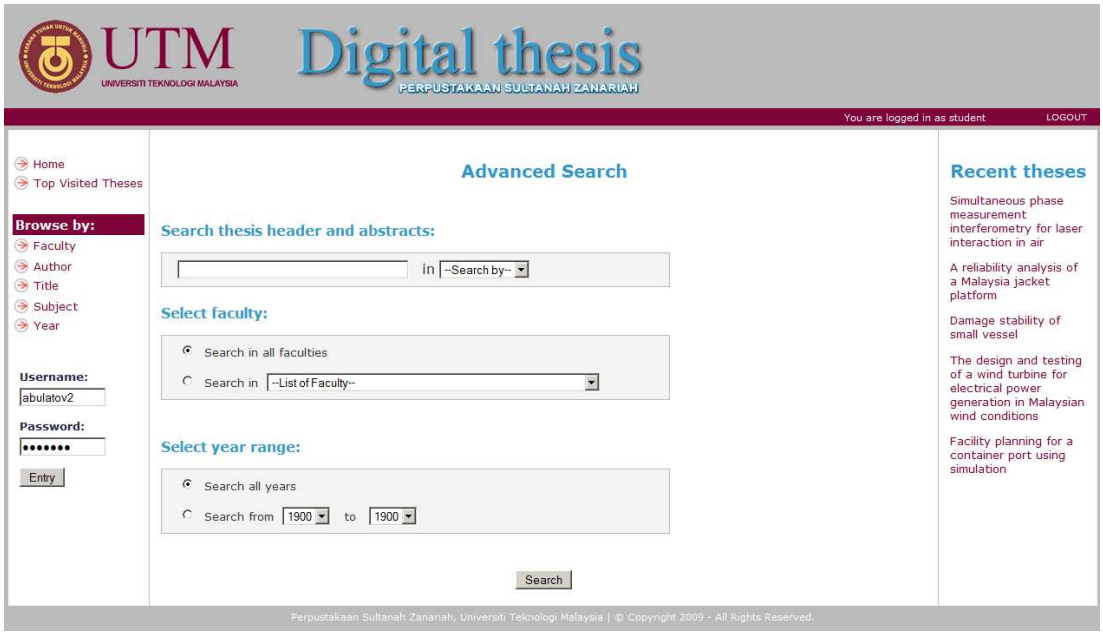


By using Basic Search, you can search thesis matching keyword in *Title, Author, Subject, and All Words*

Figure below illustrates the search results by keyword "*Facility planning*" in *All Words*

11. Advanced Search

The users can also search theses by using Advanced Search possibilities



1. Main page of librarian module

There are 2 main options for librarians: Manage thesis and Manage Faculty

2. Manage Faculty

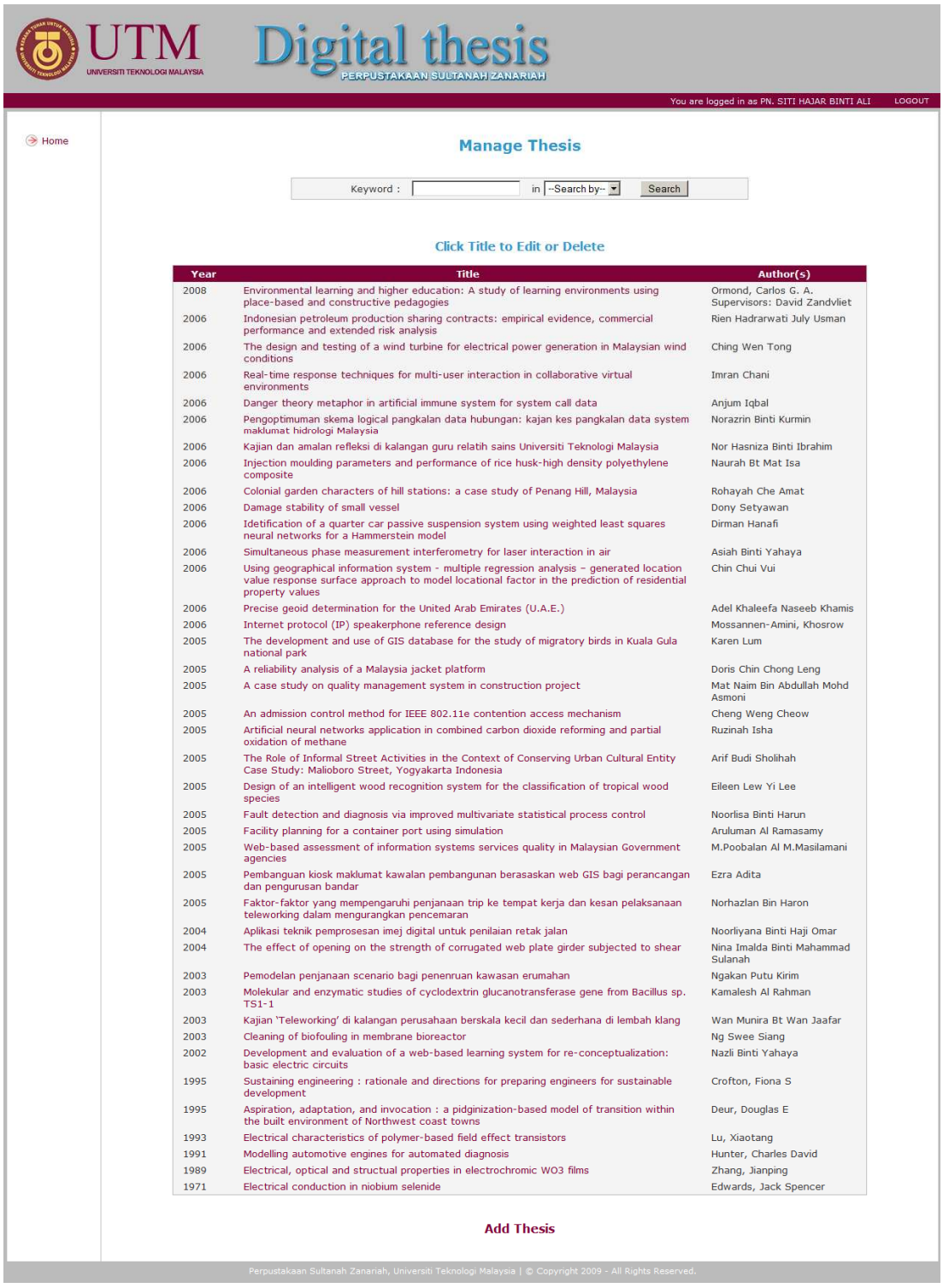
a) Click on *Manage Faculty link*

UTM
UNIVERSITI TEKNOLOGI MALAYSIA
Digital thesis
PERPUSTAKAAN SULTANAH ZANARIAH
You are logged in as PN. SITI HAJAR BINTI ALI
LOGOUT
Home
Manage Faculty
Add Faculty
No
Faculty
Edit
Delete
1 Faculty of Built Environment
2 Faculty of Civil Engineering
3 Faculty of Computer Science and Information System
4 Faculty of Education
5 Faculty of Electrical Engineering
6 Faculty of Geoinformation Science And Engineering
7 Faculty of Management and Human Resource Development
8 Faculty of Mechanical Engineering
9 Faculty of Science
10 Faculty of Biomedical Engineering and Health Science
11 Faculty of Biosciences and Bioengineering
12 Faculty of Chemical and Natural Resource Engineering
Perpustakaan Sultanah Zanariah, Universiti Teknologi Malaysia | © Copyright 2009 - All Rights Reserved.

This figure illustrates that librarians can *Add Faculty*, *Edit Faculty, and Delete Faculty*

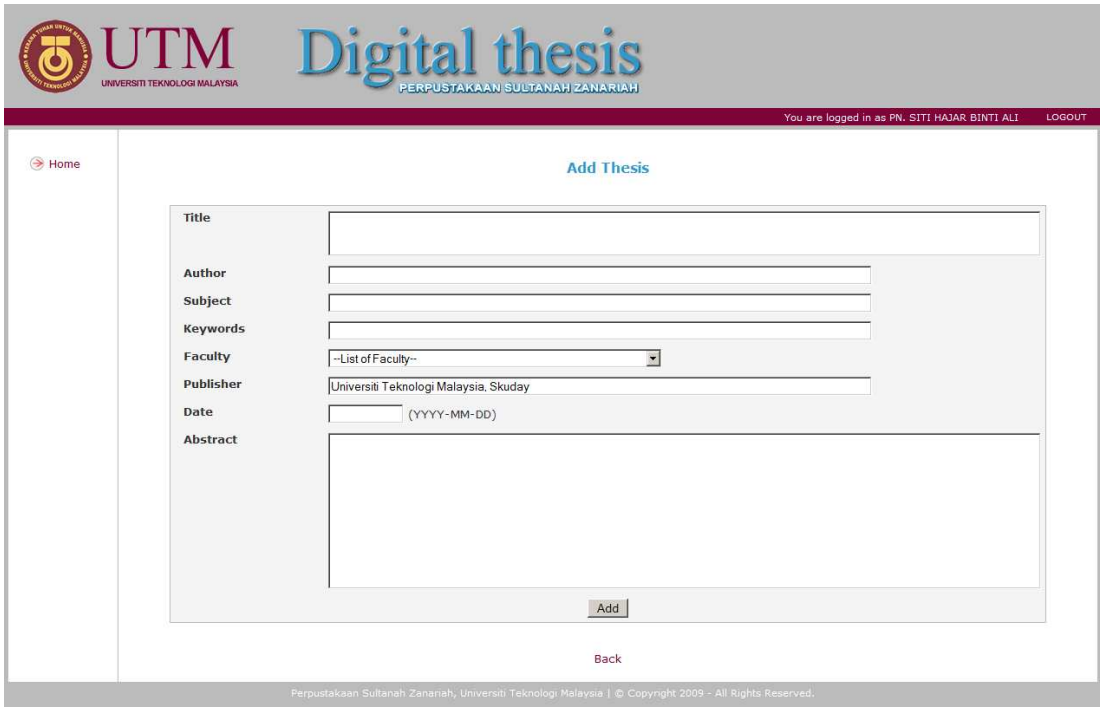
3. Manage Thesis

a) Click on *Manage Thesis link*


UTM
UNIVERSITI TEKNOLOGI MALAYSIA
Digital thesis
PERPUSTAKAAN SULTANAH ZANARIAH
You are logged in as PN. SITI HAJAR BINTI ALI
LOGOUT
Home
Manage Thesis
Keyword :
in --Search by--
Search
Click Title to Edit or Delete
Year
Title
Author(s)
2008 Environmental learning and higher education: A study of learning environments using place-based and constructive pedagogies Ormond, Carlos G. A. Supervisors: David Zandvliet
2006 Indonesian petroleum production sharing contracts: empirical evidence, commercial performance and extended risk analysis Rien Hadrarwati July Usman
2006 The design and testing of a wind turbine for electrical power generation in Malaysian wind conditions Ching Wen Tong
2006 Real-time response techniques for multi-user interaction in collaborative virtual environments Imran Chani
2006 Danger theory metaphor in artificial immune system for system call data Anjum Iqbal
2006 Pengoptimuman skema logical pangkalan data hubungan: kajan kes pangkalan data system maklumat hidrologi Malaysia Norazrin Binti Kurmin
2006 Kajian dan amalan refleksi di kalangan guru relatih sains Universiti Teknologi Malaysia Nor Hasniza Binti Ibrahim
2006 Injection moulding parameters and performance of rice husk-high density polyethylene composite Naurah Bt Mat Isa
2006 Colonial garden characters of hill stations: a case study of Penang Hill, Malaysia Rohayah Che Amat
2006 Damage stability of small vessel Dony Setyawan
2006 Idetification of a quarter car passive suspension system using weighted least squares neural networks for a Hammerstein model Dirman Hanafi
2006 Simultaneous phase measurement interferometry for laser interaction in air Asiah Binti Yahaya
2006 Using geographical information system - multiple regression analysis – generated location value response surface approach to model locational factor in the prediction of residential property values Chin Chui Vui
2006 Precise geoid determination for the United Arab Emirates (U.A.E.) Adel Khaleefa Naseeb Khamis
2006 Internet protocol (IP) speakerphone reference design Mossannen-Amini, Khosrow
2005 The development and use of GIS database for the study of migratory birds in Kuala Gula national park Karen Lum
2005 A reliability analysis of a Malaysia jacket platform Doris Chin Chong Leng
2005 A case study on quality management system in construction project Mat Naim Bin Abdullah Mohd Asmoni
2005 An admission control method for IEEE 802.11e contention access mechanism Cheng Weng Cheow
2005 Artificial neural networks application in combined carbon dioxide reforming and partial oxidation of methane Ruzinah Isha
2005 The Role of Informal Street Activities in the Context of Conserving Urban Cultural Entity Case Study: Malioboro Street, Yogyakarta Indonesia Arif Budi Sholihah
2005 Design of an intelligent wood recognition system for the classification of tropical wood species Eileen Lew Yi Lee
2005 Fault detection and diagnosis via improved multivariate statistical process control Noorlisa Binti Harun
2005 Facility planning for a container port using simulation Aruluman Al Ramasamy
2005 Web-based assessment of information systems services quality in Malaysian Government agencies M.Poobalan Al M.Masilamani
2005 Pembanguan kiosk maklumat kawalan pembangunan berasaskan web GIS bagi perancangan dan pengurusan bandar Ezra Adita
2005 Faktor-faktor yang mempengaruhi penjanaan trip ke tempat kerja dan kesan pelaksanaan teleworking dalam mengurangkan pencemaran Norhazlan Bin Haron
2004 Aplikasi teknik pemprosesan imej digital untuk penilaian retak jalan Noorliyana Binti Haji Omar
2004 The effect of opening on the strength of corrugated web plate girder subjected to shear Nina Imalda Binti Mahammad Sulanah
2003 Pemodelan penjanaan scenario bagi penenruan kawasan erumahan Ngakan Putu Kirim
2003 Molekular and enzymatic studies of cyclodextrin glucanotransferase gene from Bacillus sp. TS1-1 Kamalesh Al Rahman
2003 Kajian 'Teleworking' di kalangan perusahaan berskala kecil dan sederhana di lembah klang Wan Munira Bt Wan Jaafar
2003 Cleaning of biofouling in membrane bioreactor Ng Swee Siang
2002 Development and evaluation of a web-based learning system for re-conceptualization: basic electric circuits Nazli Binti Yahaya
1995 Sustaining engineering : rationale and directions for preparing engineers for sustainable development Crofton, Fiona S
1995 Aspiration, adaptation, and invocation : a pidginization-based model of transition within the built environment of Northwest coast towns Deur, Douglas E
1993 Electrical characteristics of polymer-based field effect transistors Lu, Xiaotang
1991 Modelling automotive engines for automated diagnosis Hunter, Charles David
1989 Electrical, optical and structual properties in electrochromic WO3 films Zhang, Jianping
1971 Electrical conduction in niobium selenide Edwards, Jack Spencer
Add Thesis
Perpustakaan Sultanah Zanariah, Universiti Teknologi Malaysia | © Copyright 2009 - All Rights Reserved.

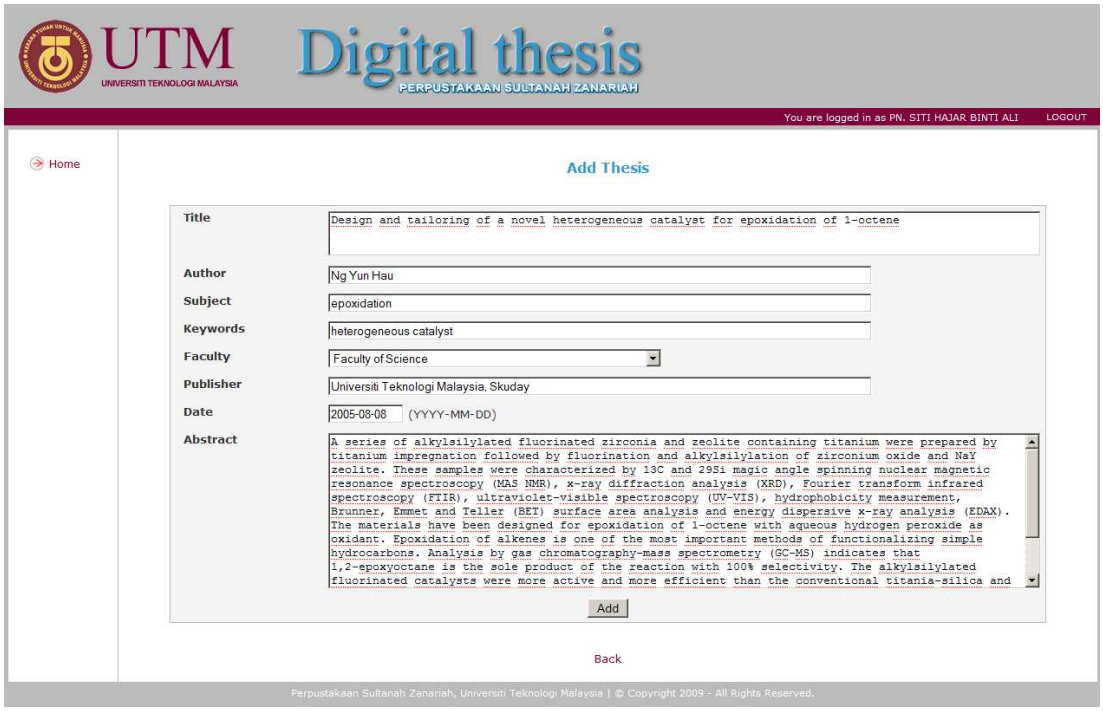
There are 3 main functions for librarians in this module: *Add Thesis*, *Edit Thesis*, *Delete Thesis.* Also librarians can search retrospective collection by *Title*, *Author*, *Subject*, *All Words.*

b) To add new thesis click on *Add Thesis* link



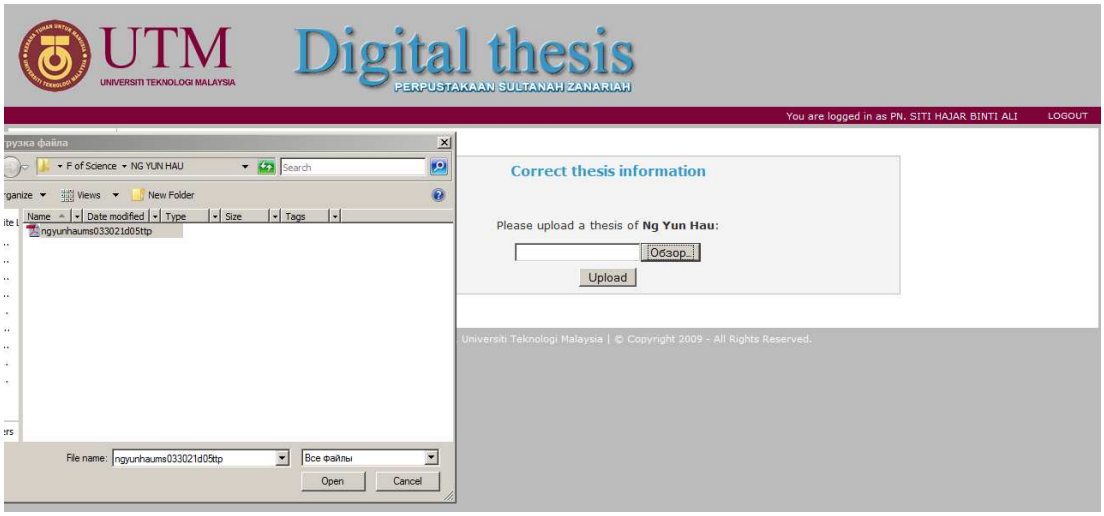
Add thesis page.

c) Inserting metadata and thesis into database


UTM
UNIVERSITI TEKNOLOGI MALAYSIA
Digital thesis
PERPUSTAKAAN SULTANAH ZANARIAH
You are logged in as PN. SITI HAJAR BINTI ALI
LOGOUT
Home
Add Thesis
Title
Design and tailoring of a novel heterogeneous catalyst for epoxidation of 1-octene
Author
Ng Yun Hau
Subject
epoxidation
Keywords
heterogeneous catalyst
Faculty
Faculty of Science
Publisher
Universiti Teknologi Malaysia, Skuday
Date
2005-08-08
(YYYY-MM-DD)
Abstract
A series of alkylsilylated fluorinated zirconia and zeolite containing titanium were prepared by titanium impregnation followed by fluorination and alkylsilylation of zirconium oxide and NaY zeolite. These samples were characterized by 13C and 29Si magic angle spinning nuclear magnetic resonance spectroscopy (MAS NMR), x-ray diffraction analysis (XRD), Fourier transform infrared spectroscopy (FTIR), ultraviolet-visible spectroscopy (UV-VIS), hydrophobicity measurement, Brunner, Emmet and Teller (BET) surface area analysis and energy dispersive x-ray analysis (EDAX). The materials have been designed for epoxidation of 1-octene with aqueous hydrogen peroxide as oxidant. Epoxidation of alkenes is one of the most important methods of functionalizing simple hydrocarbons. Analysis by gas chromatography-mass spectrometry (GC-MS) indicates that 1,2-epoxyoctane is the sole product of the reaction with 100% selectivity. The alkylsilylated fluorinated catalysts were more active and more efficient than the conventional titania-silica and
Add
Back
Perpustakaan Sultanah Zanariah, Universiti Teknologi Malaysia | © Copyright 2009 - All Rights Reserved.

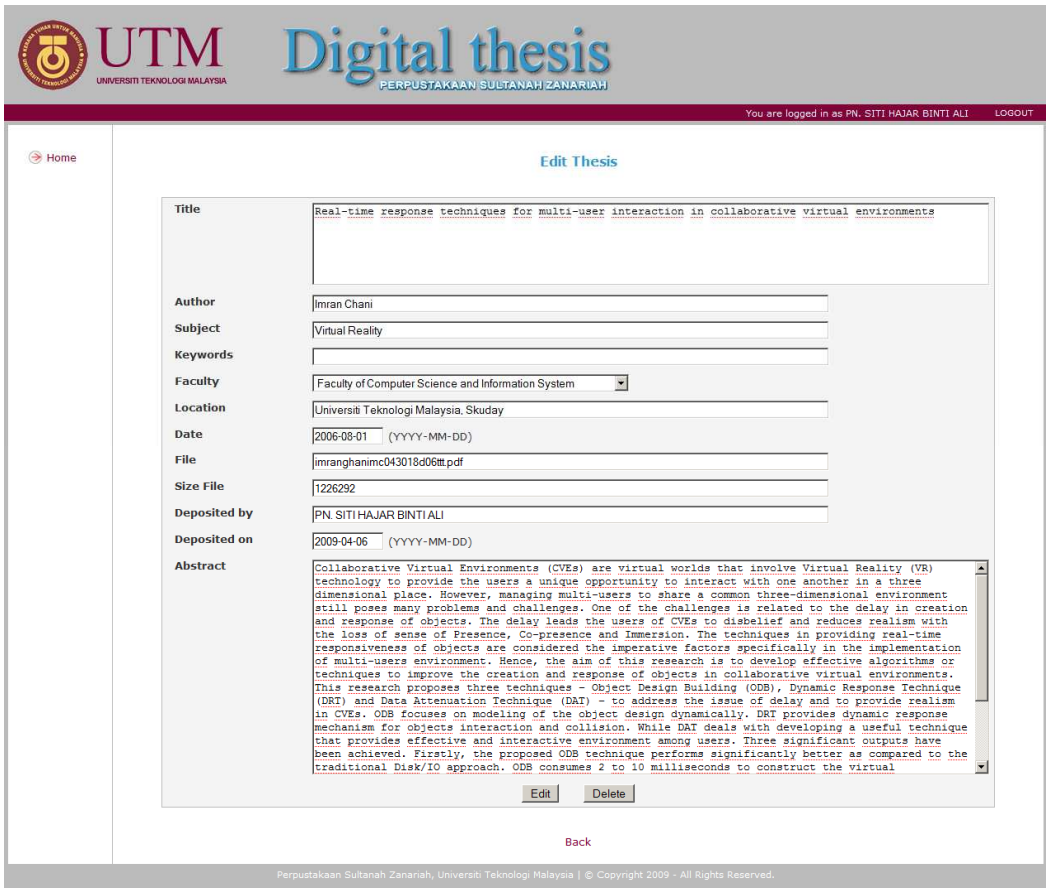
To add new thesis first of all you need to fill up this form by inserting metadata to each field. After metadata is inserted press *Add* button.

d) Uploading digitized thesis with metadata into the system



e) Editing thesis

To edit thesis just click on appropriate title or search by keyword from *Manage Thesis* page


UTM
UNIVERSITI TEKNOLOGI MALAYSIA
Digital thesis
PERPUSTAKAAN SULTANAH ZANARIAH
You are logged in as PN. SITI HAJAR BINTI ALI
LOGOUT
Home
Edit Thesis
Title
Real-time response techniques for multi-user interaction in collaborative virtual environments
Author
Imran Chani
Subject
Virtual Reality
Keywords
Faculty
Faculty of Computer Science and Information System
Location
Universiti Teknologi Malaysia, Skuday
Date
2006-08-01
(YYYY-MM-DD)
File
imranghanimc043018d06ttt.pdf
Size File
1226292
Deposited by
PN. SITI HAJAR BINTI ALI
Deposited on
2009-04-06
(YYYY-MM-DD)
Abstract
Collaborative Virtual Environments (CVEs) are virtual worlds that involve Virtual Reality (VR) technology to provide the users a unique opportunity to interact with one another in a three dimensional place. However, managing multi-users to share a common three-dimensional environment still poses many problems and challenges. One of the challenges is related to the delay in creation and response of objects. The delay leads the users of CVEs to disbelief and reduces realism with the loss of sense of Presence, Co-presence and Immersion. The techniques in providing real-time responsiveness of objects are considered the imperative factors specifically in the implementation of multi-users environment. Hence, the aim of this research is to develop effective algorithms or techniques to improve the creation and response of objects in collaborative virtual environments. This research proposes three techniques - Object Design Building (ODB), Dynamic Response Technique (DRT) and Data Attenuation Technique (DAT) - to address the issue of delay and to provide realism in CVEs. ODB focuses on modeling of the object design dynamically. DRT provides dynamic response mechanism for objects interaction and collision. While DAT deals with developing a useful technique that provides effective and interactive environment among users. Three significant outputs have been achieved. Firstly, the proposed ODB technique performs significantly better as compared to the traditional Disk/IO approach. ODB consumes 2 to 10 milliseconds to construct the virtual
Edit
Delete
Back
Perpustakaan Sultanah Zanariah, Universiti Teknologi Malaysia | © Copyright 2009 - All Rights Reserved.

After making corrections in thesis metadata press *Edit* button to update the database. To delete thesis from database click on *Delete* button.

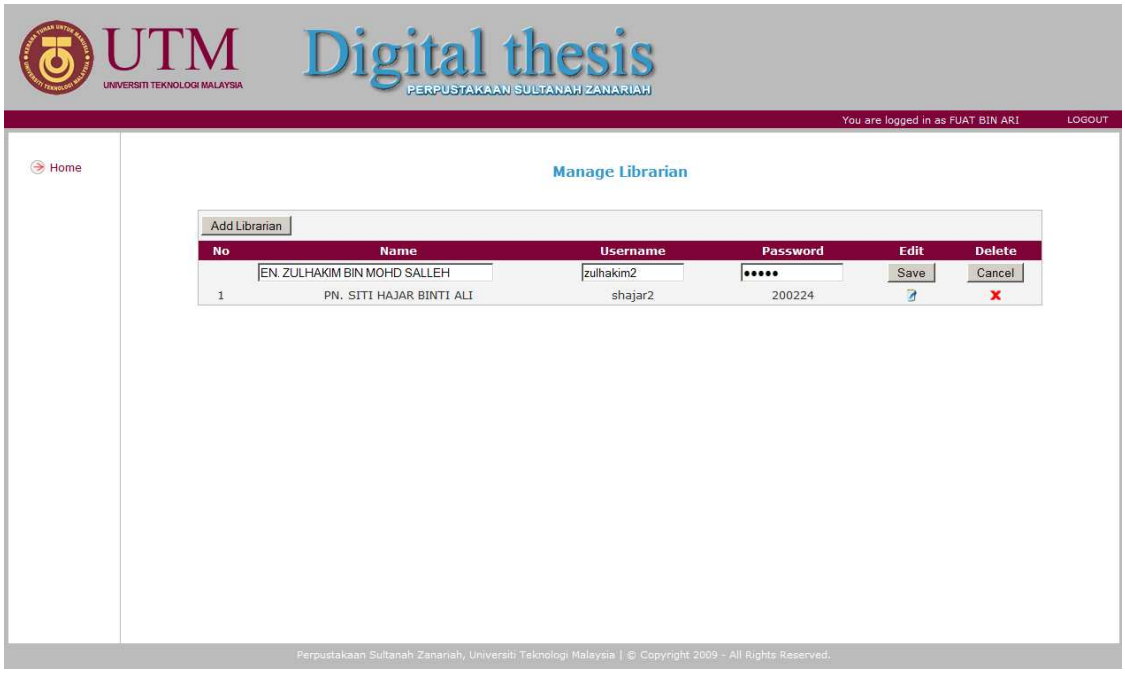
User Manual for Administrator

1. Main page of Administrator module

There are 2 main options for administrator: *Manage Librarian* and *Manage Student.* Administrator can add, delete or edit librarian and student record.

2. Manage Librarian

a) Click on *Manage Librarian link*



This figure illustrates the process of adding librarian into database

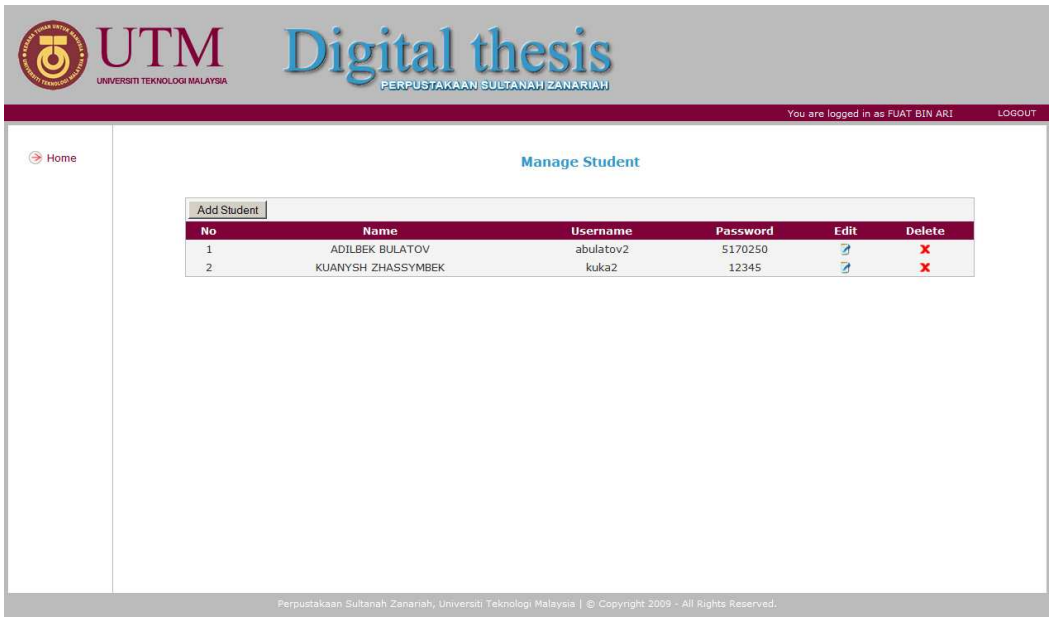
New librarian is added into database

b) To edit librarian records press *Edit* icon

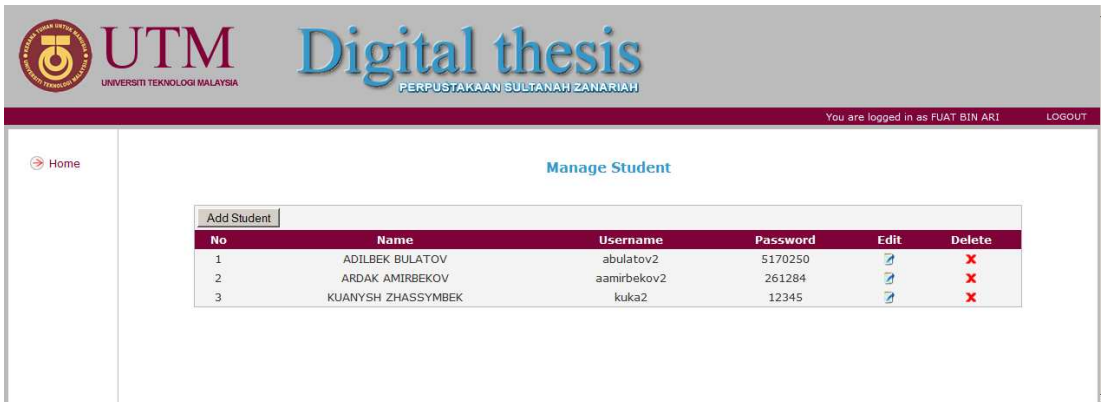
c) To delete librarian records from database press *Delete* icon

3. Manage Student

a) Click on *Manage Student link*

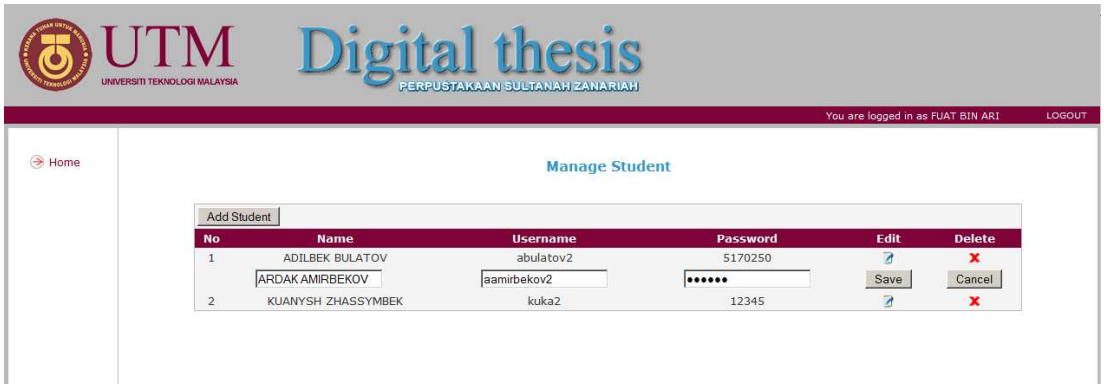


b) To add new student into database press *Add Student* button



New student is added into database

c) To edit student records press *Edit* icon



d) To delete student records from database press *Delete* icon